Performance, Performance Persistence and Fund Flows: A Comparison of Domestic vs. International Mutual Funds

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Abstract

This thesis analyzes the performance, performance persistence and fund flows for samples of both domestic and international equity unit trusts (mutual funds) using a new specially constructed dataset consisting of 650 UK domestic equity unit trusts and 627 UK-based international equity unit trusts over a sample period from January 1998 to March 2015. The comparative analysis between domestic and overseas investments provides new evidence on the mutual savings market in the UK and incorporates the effects of the financial crisis post-2008. The thesis contributes to the existing literature by providing empirical evidence on the two-step flow-performance relationship outlined in Berk and Green (2004) model for UK domestic and international mutual funds.

We find little evidence that UK domestic and international equity mutual funds earn positive abnormal returns on a risk-adjusted basis across a range of investment objectives and across many alternative benchmarks. Neither UK domestic mutual fund managers nor international mutual fund managers have the ability to time the market, nor generate positive alphas in recessions and post the 2008 financial crisis. To the extent that manager skill exists in UK mutual funds, they are limited to a smaller number of funds.

The flow-performance relationship has stronger convexity for the best performing UK domestic funds compared with international mutual funds. In comparison to domestic investor flows, international fund flows are more sensitive to risk-adjusted returns than raw returns, especially the most recent risk-adjusted performance. There is evidence that search costs affect the flow-performance sensitivity for UK domestic and international mutual funds when they are proxied by fund fees and fund family size. The impact concentrate on funds in certain performance ranges, that is, the bottom quintile and middle three quintiles, rather than all performance ranges.

We find evidence of performance persistence for UK domestic equity unit trusts at the short horizon of one month and some evidence of performance persistence for international equity mutual funds at intermediate term horizons. Long-term persistence in underperformance is also evidenced for UK domestic funds. Our results from testing for the existence of the equilibrating mechanism of fund flows outlined in Berk and Green (2004) suggests that at the one-year horizon, fund flows reduce performance persistence in UK domestic unit trusts However, we find no evidence that fund flows affect performance persistence in UK-based international equity mutual funds.

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Glossary

Term	Definition
12b-1 Fee	Fees charged against the assets of mutual funds for fund advertising and marketing as well as distribution services provided by intermediaries.
Expense	Charges that may be incurred when investments are made to mutual funds. These charges are set to cover the costs involved in operating a mutual fund, for instance, transaction costs, investment advisory fees, and marketing and distribution expenses. In this analysis, Expense is defined as the total fees measured by annual management charge plus geometric annual average of initial load amortized over five years. The term expenses, total fees and fund fees are used interchangeably throughout the thesis.
Fund Age	The age, in years, of a fund from its establishment to the time return data is recorded. In the regression analysis, ln (Age +1) is used instead of ln Age because on the launch date of a fund, ln Age would be ln 0, which is undefined.
Fund Family Size	One management company can offer a set of funds with different investment objectives. Fund family size is calculated as the sum of the total net assets of all funds that under the same management company name in our sample.
Fund Size	For any given fund, fund size is measured by the total net asset of that fund at the beginning of the time at which fund flow is computed.
IMA Sector	Investment sectors are identified by Investment Association, into which UK domestic unit trusts are classified in terms of their investment objectives. Three IMA sectors are included in this thesis, which are UK All Companies, UK Equity Income and UK Smaller Companies.
Jensen's alpha	Jensen's alpha measures the abnormal performance of a fund at the beginning of time t at which fund flow is calculated. This measure is computed using monthly returns over different horizons and against different market benchmarks.
Lipper Scheme	International equity mutual funds are categorized into different schemes in terms of their investment objectives and geographical focuses by Lipper Hindsight when IMA sectors are not available. See Table 4.1 for details of 29 Lipper Schemes.
Net Percentage Flow	Net percentage growth in fund assets of a fund over n months is calculated as the change in total net asset minus the appreciation in the fund's assets from time t-n to time t, divided by the total net asset at t-n.
Net Pound Flow	Absolute cash flow of a fund over n month is calculated as the change in total net asset minus the appreciation in the fund's assets from time t-n to time t.
Risk Aversion	Investor's behaviour that attempt to lower the uncertainty to which they are exposed. A risk averse investor will prefer the investment with lower risk when two investments with similar expected returns are available.
Riskiness	A measure of the relative riskiness of a fund and is reported in terms of fund total risk, which is computed as the standard deviation of historical returns using monthly data. The variable Risk in regression equations in Chapter 6 is identical to riskiness.
Sophisticated Investors	A class of investors who are considered to have sufficient capital, experience and market knowledge that allows them to engage in more advanced types of investment opportunities.

Chapter 1 Introduction

During the past decade mutual funds, and especially actively managed mutual funds have witnessed dramatic growth and increased popularity around the world, which has attracted the attention and interest of practitioners and academia. Financial assets under management by professional fund managers have increased at a rapid pace since 2003. This can be seen from the sharp rise in total worldwide assets under mutual fund management from $7.4 trillion in 2003 to $40.4 trillion in 2016 (Investment Company Institute, 2014, 2017). Mutual fund assets accounted for nearly one third of total fund assets and as one of the largest institutional investors in the stock market, equity mutual funds controlled 44% of total assets invested in mutual funds (Investment Company Institute, 2014). It is reported that in 2013, net new cash flow in to mutual fund industry totalled $167 billion, which is mainly represented by equity mutual funds (Investment Company Institute, 2014). The strong demand for equity mutual funds is closely related to the improving economic conditions in US and Europe and strong stock market performance after the 2007-2008 financial crisis (Investment Company Institute, 2014).

There was a temporary blip in the growth of mutual fund industry, in the immediate aftermath of the Financial Crisis of 2008. This Crisis started in the subprime mortgage market from 2007 as a result of a housing boom and bust cycle (Acharya and Richardson, 2009). It rapidly spread from the US to most financial markets in many countries with extremely destructive effect on a large number of financial institutions (Erkens, Hung and Matos, 2012). An estimate of 50 trillion dollars was reported as the total wealth destruction resulting from collapse of financial institutions and plunge in the value of various assets including stocks, bonds and property (Aisen and Franken, 2010). The drop in major US stock price indexes reached 40% in 2008, which directly lowered the total net assets of domestic equity mutual funds (Investment Company Institute, 2009). Although investors withdrew $234 billion from US stock funds as a result of stock market underperformance, the effects of outflow are partially offset by the inflows to other type of mutual funds including fixed-income funds and unit trusts because of continued and increased investor reliance on funds (Investment Company Institute, 2009). The continued reliance of households on mutual funds can be

attributed to its various benefits as a collective investment vehicle, such as diversification, professional management, liquidity and flexibility. Mutual fund investments in turn contributed to the recovery of the stock market and the growth of the economy after the financial crisis, since a significant amount of capital held by institutional investors is redistributed through investing mutual funds.

Among those countries with a highly developed mutual fund market and experiencing the 2007-2008 financial crisis, the US remains the largest source of conventional funds under management (Investment Company Institute, 2009). Therefore, most research on mutual funds has been conducted on the US mutual fund industry. In contrast, the UK, which as one of the original sources of modern asset management and the largest European centre for fund management as well as the world's second largest mutual fund market has witnessed much less research attention. In 2012, conventional funds under management in UK accounted for 8.3% of the world total and the total assets under management have achieved £5.4 trillion (Maslakovic, 2013). A net investor inflow of £22 billion in that year was also reported, driven by the performance of the stock market after the 2008 financial crisis (Investment Management Association, 2014). The UK fund industry not only contributes to the UK and world economy but also has significant research value as a mature mutual fund market with relatively easy access to extensive data, which is worth studying in-depth.

Despite of the importance of mutual fund investment to investors, capital market and the whole economy, debates about whether actively managed mutual funds can outperform the market and their passive peers, whether the performance of mutual funds will persist, and if portfolio managers really have superior ability to beat the market and attract new investments, have been and remain as top research interests in this field. With respect to mutual fund performance and performance persistence, some researchers argue that mutual funds can consistently outperform a passively managed portfolio or selected market indices, but other researchers suggest the opposite. While an average underperformance of actively managed mutual funds after fees and expenses and a lack of long-term performance persistence are widely documented in literature (e.g. Jensen, 1968; Malkiel, 1995; Gruber, 1996; Carhart, 1997; Daniel et al., 1997; Blake and Timmermann, 1998; Quigley and Sinquefield, 2000; Bessler et al., 2010; Fama and French, 2010), contradictory findings suggest that active management adds value and there exists partial persistence in fund performance as well as "hot hand" phenomenon among the best performing funds and long-term persistence in the

underperformance of worst-performing funds (e.g. Carlson, 1970; Ippolito, 1989; Hendricks, Patel and Zeckhauser, 1993; Stephen J Brown and Goetzmann, 1995; Malkiel, 1995; Elton, Gruber and Blake, 1996; Carhart, 1997; Ibbotson and Patel, 2003; Kosowski et al., 2006; Berk and Tonks, 2007; Cuthbertson, Nitzsche and O'Sullivan, 2008; Blake et al., 2014). Even after addressing survivorship bias that commonly exists in the early research and employing multi-factor performance models that capture cross-sectional variation in stock returns, the evidence provided by later studies is still mixed (e.g. Fama and French, 1993; Elton, Gruber and Blake, 1996; Carhart, 1997; Phelps and Detzel, 1997; Sheikh and Noreen, 2012). Empirical research provides alternative explanations to the underperformance of active mutual funds and the lack of persistence in performance including fees, expenses and transaction costs (e.g. Sirri and Tufano, 1998; Jennifer Huang, Wei and Yan, 2007), flows and manager changes (e.g. Gruber, 1996; Edelen, 1999; Berk and Green, 2004; Bessler et al., 2010; Rakowski, 2010), market conditions (e.g. Jones and Wermers, 2011; Kosowski, 2011), methodology employed and econometric issues (e.g. Fama and French, 1993; Elton, Gruber and Blake, 1996; Carhart, 1997; Phelps and Detzel, 1997; Petersen, 2009). In thesis, we attempt to provide additional recent evidence on fund performance and performance persistence using a range of alternative performance measures.

Investors who contribute to the growth of actively managed funds generally believe active management adds value because of superior abilities possessed by mutual fund managers, which are selectivity ability and timing ability. Stock-picking ability is measured by abnormal returns achieved through employing factor models, which has been evidenced in some literature (e.g. Kosowski et al., 2006; Barras, Scaillet and Wermers, 2010; Blake et al., 2014; Berk and Van Binsbergen, 2015). However, the evidence documenting market timing ability, which enables mutual funds benefit from changing market conditions and achieve outperformance through actively adjusting the investment portfolios' exposure to market movements is limited (e.g. Chang and Lewellen, 1984; Lee and Rahman, 1990; Busse, 1999; Bollen and Busse, 2001). The superior active skills can be identified and evaluated from four aspects, which are past performance, macroeconomic forecasting, fund characteristics and fund holdings (Jones and Wermers, 2011). Past performance and performance persistence are most commonly used measures for manager's skills, since if superior abilities do exist, the outperformance achieved by mutual fund managers might be expected to persist over time. The average underperformance of mutual funds reported in previous studies, as suggested by

Kosowski (2011), results from the statistically significant negative alphas found during expansion periods and traditional performance measures underestimate the value added by active management during market downturns. This argument was supported by Jones and Wermers (2011) who argued that investors benefit more from active management in periods of high volatility and economic downturns. Nevertheless, no empirical evidence yet exists for this argument during the recent 2008 global financial crisis, which we aim to explore in this thesis.

Recent research interest has turned to investigating whether active management adds value is due to superior abilities or just because of pure luck. As suggested by Kosowski et al. (2006), luck is an important factor in evaluating fund performance and uncovering managers' true skill especially when luck can also persist. In order to address the non-normality in the distribution of individual fund returns and distinguish skilled managers from those outperform the market purely by luck, it is necessary to apply bootstrap technique to examine the statistical significance of the alphas while controlling for luck. Evidence supporting the existence of a small group of skilled managers was found by Kosowski et al. (2006), Cuthbertson, Nitzsche and O'Sullivan (2008) and Blake et al. (2014) in both US and UK mutual fund industry while Fama and French (2010) found no evidence of managers' skills by applying an alternative bootstrap method. Research on luck vs. skill issue is quite limited, and therefore, presenting huge gaps in this research field that we attempt to fill.

Given that fund management fees depend on the value of assets under management, one of the primary objectives for any mutual fund managers is to attract more investment into their mutual funds. Inflows typically follow superior performance, suggesting an expectation of positive returns in the subsequent period while outflows normally occur after inferior performance released and are viewed a sign of future underperformance. These inflows and outflows may in turn affect subsequent performance of mutual funds. This two-step flow-performance relationship and topics related to fund flows are of great interest among scholars especially during recessions when actively managed mutual funds are expected to outperform their passive competitors and investor risk perception fluctuates significantly (Hoffmann, Post and Pennings, 2013). Scholars attempt to model this flow-performance relationship by providing explanations on the rationale behind. While a convex relationship between fund flows and past performance has been well documented in existing literature (e.g. Sirri and Tufano, 1998; Del Guercio and Tkac, 2002; Lynch and Musto, 2003; Jennifer Huang, Wei

and Yan, 2007; Goriaev, Nijman and Werker, 2008), A key question many researchers attempt to answer is if fund performance does not persistent as suggested by existing empirical results, why investors still chase past performance? Berk and Green (2004) contribute to this research question by developing a rational equilibrium model with no moral hazard or asymmetric information to explain why active managers cannot consistently generate abnormal returns. According to Berk and Green (2004), there exists differential ability to achieve superior performance across mutual fund managers and informed investors learn about managerial skills by observing historical returns. Investors compete with each other to invest in the best performing funds with the expectation to obtain abnormal returns, which leads to a non-linear flow-performance relationship – fund flows disproportionately more to past winners. However, the outperformance will be competed away by large fund inflows combined with decreasing returns to scale, which results in unpredictability of future returns to investors. However, controversy exits on whether fund flows will lead to inferior ex post abnormal returns. Berk and Green (2004)'s prediction was confirmed by several empirical studies including Berk and Tonks (2007) and Bessler et al. (2010) but challenged by smart money effect proposed by Gruber (1996) and confirmed by Zheng (1999) and Keswani and Stolin (2008). Therefore, in addition to examine the performance, and performance persistence of UK equity mutual funds, we will add to the existing literature on flow-performance relationship by empirically testing the sensitivity of fund flows to past performance and Berk and Green (2004)'s prediction of the impact of fund flows on performance persistence.

The majority of research on fund flows has been carried out to study the US mutual funds while studies that concentrate on the UK asset management industry are limited. One possible reason might be that there is no comprehensive survivor-bias-free database comparable to the US CRSP survivor-bias-free fund database available in the UK. While fund performance, performance persistence and flow-performance relationship have been extensively studied for domestic equity mutual funds; there is limited evidence of these issues for international equity mutual funds. In this thesis, we will compare and contrast the performance, performance persistence and flow-performance relationship of two investment vehicles: UK domestic equity unit trusts and UK-based international equity unit trusts with particular interest to test whether the previous evidence for US domestic equity mutual funds can be generalized to UK domestic unit trusts and whether the findings for UK domestic funds apply to international

funds with different investment objective, client characteristics and fund characteristics from funds that mainly invest in domestic assets.

1.1 Motivation and Contribution

This study is motivated by the controversies on mutual fund performance and performance persistence as well as limited research conducted on flow-performance relationship in the UK during 2007-2008 financial crisis. With the aim to shed lights on mutual fund research on Berk and Green (2004) model, we will thoroughly look into related issues including mutual fund performance, manager skill, flow-performance relationship and performance persistence. As suggested by Jones and Wermers (2011), no empirical evidence on fund performance and flow-performance relationship during the 2008 financial crisis yet exists to support the argument that active management adds more value during recessions. It is a gap we would also like to fill in this study. In addition, we aim to contribute to the limited literature on UK-based international equity mutual funds and draw a comparison of findings between UK domestic and international active mutual funds. Apart from the academic contributions, the findings with respect to active management, manager skill and investor behaviour also have great implications to UK mutual fund stakeholders in practice.

Firstly, this research is designed to gain some new evidence on the performance of UK domestic and international equity mutual funds using a variety of conditional factor models in order to contribute to the long-term controversy that exists on mutual fund performance and manager skill. Using the most recent data and allowing for the effects of the financial crisis post-2008, our thesis provides empirical evidence on the performance of UK domestic and international mutual funds in upturn and downturn markets as well as whether lagged fund size exert negative impact on both types of mutual funds. By allowing for bootstrapped standard errors, we also attempt to separate skill and luck in fund performance and examine whether there exist professional fund managers who have sufficient skill to deliver superior performance for both UK domestic and international equity mutual funds. In addition, our discussion on fund performance based on comparisons drawn between UK equity domestic unit trusts and international equity unit trusts may offer new evidence on whether UK domestic unit trusts outperform international equity unit trusts or not.

The second contribution and one of the main motivations of our thesis is to provide evidence

on the relationship between fund flows and past performance for both UK domestic and international equity mutual funds. The evidence on the sensitivity of fund flows to past performance is limited for UK equity mutual funds and international equity mutual funds. This is surprising since the UK has the world's second largest fund industry. Although UK mutual fund industry is highly developed, it exhibits has distinct characteristics from its US peers. For instance, UK mutual funds are more client-oriented and invest less heavily in equities than US mutual funds. The difference in macroeconomic conditions, industry characteristics, and government policy will significantly impact investment styles, strategies as well as investors' behaviour. We aim to examine whether the results found from US market can be generalised to UK domestic mutual funds and whether the flow-performance relationship for domestic funds is significantly different from that for international funds. This thesis also examines the determining effect of various fund characteristics on future fund flows as well as whether search costs significant impact on the sensitivity of fund flows to past performance. In addition, we attempt to provide evidence on whether there are any changes in the flow-performance relationship post 2008 financial crisis for both UK domestic and international mutual funds, which has not drawn much attention in previous literature. The comparative analysis between UK domestic equity funds and international equity funds on the determinants of fund flows and convexity in flow-performance relationship offers new evidence for UK mutual fund investor behaviour especially the international mutual fund investor's behaviour and has great implication on our empirical test of Berk and Green (2004) model.

Thirdly, this thesis contributes to existing literature on performance persistence and empirical test of Berk and Green (2004) model for UK domestic and international equity mutual funds. The comparative analysis of performance persistence between UK domestic and international mutual funds at various term horizons using alternative factor benchmark models and employing recursive portfolio approach provides evidence on the level of performance persistence for both types of funds at different term horizons. The empirical test of the equilibrating mechanism of fund flows in Berk and Green (2004), which predicts that large fund inflows combined with diseconomies of scale will negatively affect ex post abnormal fund performance at term horizon of 12 months provides new evidence on the impact of fund flows on subsequent fund performance for both UK domestic and international equity mutual funds, which has not been thoroughly studied before.

1.2 Summary of Empirical Results

We find that there is little evidence of abnormal performance and market timing skill across a range of investment objectives and across many alternative benchmarks for both UK domestic equity unit trusts and international equity unit trusts. The top UK-based international fund outperforms the best performing UK domestic fund though the bottom international fund performs as poorly as the worst performing domestic fund. There is some evidence that UK domestic equity unit trusts significantly outperform the benchmark in up-markets but show little evidence of outperformance in down-markets and post the 2008 financial crisis while international equity mutual funds show little evidence of abnormal performance in either bull or bear markets. Fund size is found to be negatively related to subsequent risk-adjusted performance for both UK domestic and international equity unit trusts while controlling for other fund characteristics including fund family size, fund expense and fund age. The bootstrap simulation results suggest that there exist a small number of fund managers who possess superior skill to outperform the benchmark for both UK domestic and international mutual funds.

Compared to UK domestic equity unit trusts, fund flows into UK-based international equity mutual funds are more sensitive to risk-adjusted performance though lagged net returns are also determinants of future fund flows. There is evidence that international fund investors update the performance information in a timelier manner than domestic fund investors. Besides, the discrete event of beating a market benchmark is found to be an important determinant of future fund flows to domestic and international fund investors. The flow-performance relationship is convex for both UK domestic and international mutual funds while a stronger convexity of the flow-performance relationship is evidenced for the best performing domestic funds. Fund total fees and fund family size, as material measures for search costs can affect the flow-performance sensitivity for UK domestic and international mutual funds. The impact concentrate on funds in certain performance ranges, for instance, the bottom quintile and middle three quintiles, rather than all performance ranges.

There is little evidence of performance persistence for UK domestic equity funds at intermediate term horizons, though some evidence of persistence in UK domestic fund performance at the very short and long-term horizons is found. The long-term persistence in performance is mainly caused by the persistent underperformance of the bottom quintile

funds. For UK-based international funds, there is some evidence of performance persistence at short and intermediate term horizons. Persistence in the performance of regionally focused international funds that include all emerging market funds in our dataset is found to cause the persistent outperformance of the best performing international funds. The empirical test of the equilibrating mechanism of fund flows suggests that at 12-month term horizon, domestic funds that attract large net fund inflows do not outperform those funds that have smaller fund inflows, which provide some evidence that large net fund inflows deteriorate subsequent abnormal performance of UK domestic unit trusts. In contrast, the findings for international equity mutual funds are in general not supportive of Berk and Green (2004)'s arguments.

1.3 Organization of the Thesis

The remainder of the thesis is organized as follows. Chapter 2 contains overview of features and characteristics of UK unit trusts/OEICs. Chapter 3 provides a literature review on fund performance, performance persistence and fund flows for domestic and international equity mutual funds. Chapter 4 details the methodologies and dataset we employ in this thesis. Chapter 5 evaluates fund performance, Chapter 6 examine the relationship between fund flows and past performance and Chapter 7 tests performance persistence and Berk and Green (2004) model of fund flows for UK domestic international equity mutual funds. Chapter 8 concludes and provides the implications of the findings as well as a discussion on further research.

Chapter 2 The Features of Mutual Funds and Overview of UK Fund Industry

2.1 The Definition of Mutual Funds

A mutual fund is a type of professionally managed investment vehicle, which pools large sums of cash from many sources and collectively invests those assets in accordance with the investment objectives in a range of financial instruments including bonds with different maturity periods, domestic and international equities, real estates, etc. (Investment Company Institute, 2003). Investors own units or shares in the mutual fund in terms of the relative size of their investments. These shares can be flexibly repurchased and redeemed at a net asset value, which is estimated from dividing the difference between total assets and liabilities by the outstanding number of shares (Bodie, Kane and Marcus, 2005). The main costs and expenses incurred in investing a mutual fund include front-end loaded fees, back-end loaded fees, as well as the general costs of administering and management fees. Front-end load fees are paid when investors enter into a mutual fund while back-end load fees are paid at redemption. Management fees are usually paid annually to cover operating expenses and any commissions paid to investment advisors.

Compared to investments made by individual investors directly, there are a number of advantages associated with investing in mutual funds. Mutual funds make it possible for individual investors with limited time and knowledge on strategic investment decision-making in a changing financial market to have access to invaluable information, professional management and consulting service. Mutual fund investors benefit from increased diversification, lower transaction costs and more investment opportunities, which are used to be accessed by large institutional investors only as well as enjoy some other advantages including higher liquidity, flexibility and convenience in trading. Therefore, an increased investor reliance on mutual funds was reported even during the financial crisis (Investment Company Institute, 2009). However, disadvantages also exist, which includes fee charges, the lack of control over every investment in the fund and the loss of share ownership rights. In general, professionally managed investment vehicles especially mutual funds are a viable alternative investment option for individual investors. It boosts the rise of security markets by

providing more participation opportunities to individual investors and helps stabilize financial markets by spreading capital across a range of financial instruments. Besides, mutual funds contribute to pension plans, which meet retirement needs in many countries, which faces an increasing aging population.

Mutual funds are established to achieve certain investment aims. The main investment aims include capital growth from increases in the holding securities' prices and income generation from dividend or interest paid periodically. These objectives can be achieved through investing in portfolios containing a wide range of securities. The information on fund investment approaches and the detailed composition of investment portfolios is released to the investors so that they can identify the investment style of each mutual fund and decide whether it will meet their investment aims. According to Investment Company Institute (2003), mutual funds can be classified into four main categories based on investment style and principal securities held, which are equity funds, bond funds, money market funds and hybrid funds. Equity funds primarily invest in equity shares while bond funds mainly invest in fixed income securities. Hybrid funds, as the name suggests, invest in portfolios with a mix of stocks and bonds, or convertible securities. Money market funds, the only short-term investment funds among the four invest in money market instruments with a very short time to maturity, which are an alternative to bank savings.

Equity mutual fund is the focus of this study, which can be further classified into domestic equity funds, global equity funds and international equity funds. When investment is primarily made to domestic shares, it can be defined as domestic equity funds while global equity funds invest in both domestic and foreign shares. International equity funds, in contrast, mainly focus on foreign shares. Sometimes, the term global equity funds and international equity funds are used interchangeably. Equity funds can also be classified according to the specific industry or sector that the equity fund targets for, for example, the finance sector and the technology sector. With reference to the investment style, the equity fund can be classified as growth, blend and value funds. Growth funds mainly invest in growth stocks while value funds aim to invest in the shares of companies, which appear to be undervalued. Blend funds invest in a portfolio comprising of both growth and value stocks.

2.2 Open-End Mutual Funds

Mutual funds can take different forms. The three main types of mutual funds defined in Investment Company Institute (2003) are: open-end mutual funds, which is the focus of this thesis, closed-end mutual funds and exchange-traded funds.

A mutual fund that is defined as open-end mutual fund meets two requirements. Firstly, the outstanding shares of the mutual fund can be issued and redeemed at any time upon the request of shareholders, and at a price based on the underlying net asset value of the fund's portfolio (Investment Company Institute, 2003). Secondly, there is no legal limit on the number of new fund shares issued to the public. It means that all open-end mutual funds continuously offer new issues to the public. Investors normally purchase shares directly from the fund rather than the existing shareholders, and the fund must be willing to buy back the shares from investors at the end of every trading day at the net asset value per share computed on that trading day. Therefore, investors can tell the performance of an open-end mutual fund directly from the buy and sell prices for fund shares. Open-end mutual funds can be actively managed by professional investment managers who oversee the fund portfolio and execute all buying and selling decisions, or passively managed through adjusting the composition of the investment portfolio to closely track certain indices.

2.2.1 Unit Trusts and OEICs

In the UK, unit trusts and open-ended investment companies (OEICs) are two main open-ended collectively investment schemes, which allow investors to gain ownership of a diversified investment portfolio constituted and managed by a professional asset management company through directly investing in the scheme. Unit trusts, as suggested by its name, are established under trust laws. Its daily operation and management are regulated by Financial Service Authority (FSA)[1]. It can be defined as an open-end mutual fund with unincorporated structure. There are mainly three parties involved, which are investors, fund managers and trustees. Investors are unit holders who benefit from investing in unit trusts and have the right to buy units from and sell units back to the trust. Fund managers are appointed to run the trust and make investment decisions. Trustees, normally a financial institution, are responsible for

[1] The FSA was abolished with effect from 1 April 2013. It has now become two separate agencies: the Financial Conduct Authority and the Prudential Regulation Authority.

monitoring the management activity and ensure the trust functioning in line with trust deed as well as regulations and rules imposed by the FSA.

OEICs are similar to unit trusts but with a formal corporation structure and governed by company law. OEICs are managed by an authorized corporate director while the investments are held by depositors. Since they are also open-ended mutual funds, they are governed by the same regulations and rules as unit trusts. In comparison to unit trusts, OEICs normally issue different share classes to target customers, either retail or institutional, which can meet diverse demand of different types of investors. In contrast, the units issued by unit trusts can be either accumulation units or income units. Accumulation units reinvest the dividends paid by the underlying equities back into the underlying assets without distributing dividends while income units regularly distribute the dividends paid by the underlying assets to investors. Unit trusts use a dual pricing system, which means they have two prices: bid price and offer price. Offer price is the purchase price for unit trust investors while bid price is the sale price, which fluctuates in response to the price movements of underlying assets. Therefore, a bid-offer spread can be made by fund managers. Fund managers adjust the bid-offer spread to capture market movements and control liquidity. In contrast, OEICs only have one price, which make it more appealing to investors.

2.2.2 Charges and Taxation

The fee charges vary across mutual funds with different legal structure and should be clearly defined in the prospectus and legal documentation. The dual pricing system employed by unit trusts introduce the bid-ask spread, which is normally used to cover marketing and advertising expenses as well as pay commissions to brokers and financial advisors. The front and back end loads, which are levied on investors when the first time they enter and leave a fund, do not apply to every fund. Some funds do not have an initial charge, which might attract more investors because of lower entry cost. These funds, however, have back-end loads, which encourages investors to stay longer in the collective investment scheme. Commissions are paid during transactions and annual management fees, which cover daily operating expenses and any commissions paid to investment advisors, are set as a percentage of total asset under management. To measure the total cost incurred in investing a mutual fund, total expense ratio is reported annually by fund managers. Fund fees normally have negative impact on future fund flows. It is because the cost of investing in the fund would rise when fees are

incurred though some of these charges using for marketing and promoting the fund could reduce search cost for investors (Sirri and Tufano, 1998). Besides, fee changes are also strongly related to future fund flows especially decrease in annual management fees, which would significantly reduce the price of the fund (Sirri and Tufano, 1998). There is no significant difference between unit trusts and OEICs with respect taxation of fund. Both collective investment vehicles are not liable to UK corporation tax on capital gains but taxed for income from investment at the lower rate of corporate tax, normally around 20%.

2.2.3 Fund Schemes and Classifications

To simplify the decision-making process for choosing among various funds, The Investment Association[2] divides around 2500 UK funds into over 30 categories. The classification is based on the underlying securities invested such as equities and mixed assets as well as the investment strategy such as growth-oriented and income-oriented. There are four broad classes, which are Growth, Income, Capital Protection and Specialist funds. Each class focuses on specific fund characteristics. For instance, the growth fund category consists of capital return and growth funds while the income fund category mainly focuses on funds with investment aim of achieving short-term and long-term income. Since our research is conducted on domestic equity mutual funds, we will introduce some of the fund categories for UK domestic equity unit trusts/OEICs that will be included in our sample. A fund classified as UK Equity Income should invest at least 80% of their assets in UK equities and with a target of attaining a yield in excess of 100% of the FT All Share Index yield. UK All Companies includes funds investing at least 80% of their assets in UK equities with a primary objective of achieving capital growth. UK Smaller Companies consists of funds investing at least 80% of their assets in UK equities of the smallest 10% companies. Lipper, a leading fund data provider, has its own sector classification for mutual funds. The fund schemes of UK-based international equity mutual funds in our sample adopt Lipper Global Classification, which group funds with comparative objectives in terms of asset type, market capitalization of underlying assets and geographical focus. For example, Equity Asia Pacifica is an equity class fund with a geographical focus of Asia Pacific markets while Equity China Small&Mid Cap mainly invest in the equities in China following a specific small- or mid-cap strategy.

[2] The trade body was named as "Investment Management Association" before 2015. After the merger with the Investment Affairs division of the Association of British Insurers in 2015, it changes its name to "Investment Association".

2.3 Overview of UK Asset Management Industry

UK is the largest European centre for fund management and world second largest fund market with conventional funds under management in 2015 accounting for 6.6% of the world total (Financial Conduct Authority, 2016). The total assets under management in UK achieved £6.8 trillion at the end of 2014 when £1.2 trillion was invested in retail investment product while 2.1 trillion was professionally managed on behalf of pension fund investors (Financial Conduct Authority, 2016). There was a sharp decrease of total asset under management during financial crisis in 2008. However, the fund industry quickly recovered in 2009 and kept attracting new investments and money inflows since then. Although the number of fund managers declined between 2013 and 2014, the number of mutual funds as well as the total UK asset under management increases. In 2013, a net investor inflow of £22 billion was reported, which was driven by booming stock market after financial crisis (Investment Management Association, 2014). UK fund industry contributes greatly to the prosperity of UK capital market, job market and the growth of the economy.

The asset management industry has played an important role in the UK economy. It generated about 1% of UK GDP in 2015 (Financial Conduct Authority, 2016). Fund managers make great contribution to the economy through boosting the UK's capital market and develop a wide cooperation with other financial services providers, such as banks, securities dealers and information providers. However, the great success of actively managed mutual funds in 2012 deepens the debate on active management versus passive management in UK mutual fund industry. Over the past ten years, passively managed funds were once considerably profitable and claimed to conform to investors' changing needs and investment objectives. In the UK asset management industry, retail funds accounted for 67% of total funds under management and net retail sales increased £6 billion from 2012 to 2013, reaching £20 billion in 2013 (Investment Management Association, 2014). Households are concerned more about stable income and capital preservation after the dot.com crisis and the financial crisis of 2008 as a consequence of a lack of trust in banks and building societies (Investment Management Association, 2014). The profitability of active management appears to strengthen the traditional concept that active management adds value. However, index funds also benefit from the favorable economic condition and strong performance of stock market recently, which obtain the highest cash inflows ever.

The UK mutual fund industry started to grow rapidly from 1960s. The significant growth in 1990s can be attributed to the strong performance of equity markets while in 2009-2011, retail investors contributed a great amount of money into fund industry as a response to the first year of global financial crisis (Investment Management Association, 2014). In 2012-2013, the recovering equity markets continued to attract large fund inflows to the asset management industry. Retail investors contributed the most to the net cash inflows during 2012 and most investments were made to fixed income funds in the UK. However, in 2013, fixed income funds experienced net outflows while equities regained its popularity. Investors concern more about absolute returns than before, which is supported by an increase in investment interest on absolute return funds. They show preference over funds with higher income and managers focusing more on fund performance, but also show more concern over uncertainty in stock market and bank solvency. However, the drivers of fund flows are still uncertain. One possible explanation can be the significant changes of UK households saving habits. In the context of a positive macroeconomic environment, households increasingly invest their available income into mutual funds, which is considered as an important channel for saving though the aggregate saving rates decreased in 2013 (Investment Management Association, 2014). Besides, an inverse relationship between net retail flows into bank and building society and into mutual funds were also observed right after the start of global financial crisis (Investment Management Association, 2014). The asset reallocation from deposit to investment funds may be due to the low interest return generated by bank savings. There was some evidence that retail investors fund flowed into equities from other asset classes in 2013. Besides, developed market equities received more fund inflows while emerging market equities became less attractive (Investment Management Association, 2014). Nowadays, the UK fund market remains a highly competitive market though assets are gradually flowing to the largest funds from the smallest funds.

Chapter 3 Literature Review

Modern portfolio theory, which was introduced by Harry Markowitz in 1952, offers two main reasons for the importance of building and investing in collective investment funds. Firstly, in a world where most investors are assumed to be risk-averse and are mean variance optimisers, collective investment schemes can help individual investors maximize expected return at any given level of risk. Secondly, by investing in well-diversified portfolios constructed by professional fund managers, individual investors can reap the benefits of diversification at a relatively lower cost. While the underlying assets are not perfectly correlated, the increase of portfolio size by adding more assets can result in a reduction in the riskiness of the whole investment portfolio without lowering the expected return since the firm specific risk can be diversified away, leaving the portfolio only exposed to the undiversifiable market risk. Thus, In CAPM context, investors are advocated to hold a well-diversified market portfolio, which diversifies widely among asset classes, firm sizes, industry sectors, and investment objectives. However, the benefit of diversification is diminishing as the number of securities included into the portfolio increases. Over diversification sometimes can even hurt investment returns to individual investors considering the transaction costs incurred. Thus, a trade-off between diversification benefits and transaction costs is involved in the strategic investment decision-making process (Shawky and Smith, 2005)[3]. Considering the extra transaction costs involved when portfolio size increases, it is widely accepted that around 30 stocks are sufficient to construct a well-diversified portfolio with almost all the firm-specific risk being eliminated (Statman, 1987).

Reilly and Brown (2002, p.201) further point out that although systematic risk cannot be diversified away, investors might reduce the systematic risk of their investment portfolios by diversifying globally rather than investing in domestic stocks only since the systematic risk factors are not perfectly correlated across different countries. Theoretically, a well-diversified market portfolio should consist of all types of assets in all markets, in another word, a global

[3] Individual investors can achieve diversification, lower transaction costs and tax efficiency via owing an indexed stock Exchange Traded Funds (ETFs). An ETF, which owns underlying assets and divides ownership of those assets into shares, is established very like a close-end fund. However, ETFs differ from mutual funds as ETF shares are marketable, which trade like common stocks on an exchange. Investors can buy and sell an ETF at the end of each trading day at its net asset value or throughout the trading day at the price determined by supply and demand. Potential arbitrage opportunity exists if the price of an ETF deviates from its net asset value. Therefore, it eliminates the risk of large deviation of price from its net asset value (Elton and Gruber, 2013).

market portfolio. Investors should not expect to achieve potential benefits from international diversification by merely investing in collective investment vehicles with domestic or local focus only, especially when Busse, Goyal and Wahal (2013) suggest that diversification seems to be the prominent reason for investing globally. Hence, considering the cost of purchasing sufficient number of stocks to construct a well-diversified portfolio, especially a well-diversified global market portfolio and the associated transaction costs, a better option for individual investors is to make investment via collective investment vehicles, which pool the limited capital of individual investors and provide portfolio diversification at a relatively lower cost through economies of scale.

Despite of the importance of the collective investment vehicles to individual investors, the debates on whether actively managed mutual funds can outperform the market and their passive peers, whether the performance of active mutual funds will persist and if portfolio managers really have superior ability to beat the market and attract new investments have been and remains as top research interests. Most of the controversies on these topics are related to the role of active portfolio management. Under the assumption that semi-strong form of market efficiency holds, neither individual investors nor active fund managers should consistently generate abnormal returns in consideration of the risk involved. If actively managed portfolios fail to outperform the passive benchmark, individual investors will have no incentive to pay extra fees to acquire active portfolio management. Instead they simply turn to passive investing and invest in those index funds or tracker funds, which provide diversification at a lower cost compared to active funds, as they do not require the same level of professional investment analysis and active management of portfolios as actively managed mutual funds. However, Jones and Wermers (2011) put forward that the market should not be completely efficient. A rational investor should earn excess returns to cover this cost involved in acquiring information and thus their incentives of gathering information can be maintained. If the market is completely efficient, passive strategy will be the optimal choice for rational investors and no average fund can gain abnormal returns other than market returns. As a result, there is no need for market participants to collect and analyze information and the market is not able to achieve price, information and allocation efficiency. If the market is mostly efficient, active management can create more social wealth and make the market more efficient by improving capital allocation and excess returns gained can be viewed as a kind of economic rent (Jones and Wermers, 2011).

Examining fund performance and performance persistence is also direct test of the efficient market hypothesis (EMH). Most exiting evidence gained from investigating fund performance and performance persistence of actively managed mutual funds is in favour of the semi-strong form of market efficiency (e.g. Jensen, 1968; Shawky, 1982; Fama and French, 1992; Malkiel, 1995; Gruber, 1996; Carhart, 1997; Blake and Timmermann, 1998; Malkiel, 2003a, b; Fama and French, 2010; Malkiel, 2011) while some anomalies uncovered challenge the empirical validity of EMH and prompt the rise of behavioural finance (e.g. Jegadeesh and Titman, 1993; Lakonishok, Shleifer and Vishny, 1994; Zhiwu Chen and Knez, 1996; Shleifer, 2000; Campbell and Shiller, 2001; Vuolteenaho, 2002). The majority of these studies concentrate on the US domestic equity mutual funds while less attention has been paid to other markets or international equity mutual funds. Developed markets like US and the UK are normally deemed as mostly efficient markets and possess the best asset classes. However, the evidence that supports EMH in other individual markets and regional markets especially the emerging markets are limited (e.g. Bwo-Nung Huang, 1995; Abraham, Seyyed and Alsakran, 2002). Though potential difficulties include restrictions on capital flows, higher taxes and transaction costs, exchange rate risks, asymmetric information, time lags and search cost exist in investing globally, one important reason for the increasing emerging market participation via international mutual funds is to exploit market inefficiency in emerging markets. Apart from validating the EMH in different markets, one question many researchers attempt to answer is: if fund performance does not persistent as suggested by existing empirical results, why investors still chase past performance? Berk and Green (2004) contribute to this research question by developing a rational equilibrium model with no moral hazard or asymmetric information to explain why active managers cannot consistently generate abnormal returns. According to Berk and Green (2004), there exists differential ability to achieve superior performance across mutual fund managers and informed investors learn about managerial skills by observing historical returns. Investors compete to invest in the best performing funds with the expectation to obtain abnormal returns, which leads to a non-linear flow-performance relationship – fund flows disproportionately more to past winners. However, the abnormal performance of past winners would be competed away by these fund inflows because of decreasing returns to scale, which results in unpredictability of future returns to investors. With the development of this equilibrium model, the impact of

fund flows and investor behavior on performance persistence in mutual funds has drawn more attention in recent studies.

In the past two decades, the advance in fund performance measures and econometric techniques as well as the development of comprehensive survivorship bias free databases boost the research on fund performance and performance persistence. Recent studies utilize alternative performance measures including unconditional and conditional factor models as well as more sophisticated and rigorous econometric methods, for instance, bootstrap simulation and false discovery rate to study fund performance and manager skill (e.g. Kosowski et al., 2006; Cuthbertson, Nitzsche and O'Sullivan, 2008; Barras, Scaillet and Wermers, 2010; Fama and French, 2010; Cuthbertson, Nitzsche and O'Sullivan, 2012). In addition to the performance of domestic equity mutual funds that has been widely studied, the increasing popularity of international equity mutual funds as a new investment channel for retail investors has inspired research on the benefits of international diversification and international investment strategy, which can be examined by evaluating the performance and performance persistence of international funds. In the following sections, literature on performance, performance persistence and fund flows will be reviewed in sequence with a special focus on those studies conducted on US and the UK domestic equity mutual funds as well as international equity mutual funds.

3.1 Performance

3.1.1 Performance Measures

A key question that most researchers try to answer in existing literature is whether professional fund managers add value in an efficient market (Jones and Wermers, 2011). The semi-strong form of efficient market hypothesis asserts that rational investors should not trade on historical prices and publicly available information as all of them have been fully incorporated and reflected in the current price. Therefore, in an informationally efficient market, on average fund managers cannot consistently beat the market while outperformance only can be achieved by chance.

To examine whether active management adds value, abnormal returns need to be calculated using asset pricing model to account for risk taken. Among the various performance measures

utilized by the researchers to analyze fund performance, the most commonly used risk-adjusted performance measures are CAPM, Fama and French three-factor model and Carhart four-factor model. A main contribution of CAPM is the objective nature of the expected return on investment estimated by the model. The notion that return is rewarded by bearing risk and in particular undiversifiable risk, which is emphasized by CAPM, has influential impact on the development of performance evaluation and investment practice, though this single factor model suffers from some disadvantages including the strong and unrealistic assumptions that always fail to hold in practice and lead to invalid estimation of the benchmark return and systematic risk and the unobservable benchmark portfolio that leads to questionable validity of CAPM (Roll, 1977). Multi-factor models are developed to address the problem arising from the empirical evidence that expected returns cannot be fully explained by a single market risk factor but better estimated by multiple risk factors and become more predominant (e.g. Ross, 1976; Nai-Fu Chen, Roll and Ross, 1986; Connor and Korajczyk, 1986; Fama and French, 1993; Jegadeesh and Titman, 1993; Carhart, 1997; Acharya and Pedersen, 2005). Fama and French (1992) proposed their three-factor asset-pricing model by relaxing the strong mean-variance assumptions of the CAPM and attributing cross-sectional variation in returns to portfolio exposures to various risk factors that reflect the characteristics of financial market and firms. Carhart (1997) further cleared the alpha and uncovered whether a fund manager really have stock-picking ability, or he achieve outperformance by simply following momentum strategy and picking the past winners. The alpha that is calculated from the aforementioned three unconditional factor models does not differentiate a fund manager's market timing ability from his security selection ability when measuring fund manager skill. In addition to identifying underpriced stocks to achieve superior performance given the risk taken, fund managers are expected to have the ability to successfully forecast future market price movements and adjust the portfolio risk exposure to the aggregate market accordingly. Skilled fund managers can generate abnormal returns from temporary shifts in the fund betas depending on the successful prediction of market trends by switching from one asset class to another. In expansions, skilled equity fund managers should invest more heavily in aggressive stocks with high beta, which tend to outperform the market while in recessions, switching into defensive stocks with low beta that remain stable and tend to deliver better performance than the market signals superior market timing ability of active fund managers. Therefore, market timing ability of professional fund managers can enhance

fund performance in different market conditions especially a market downturn when the value added by active mutual fund managers matters most to investors. To capture fund managers' market timing ability, some literature advocates employing the market timing measures developed by Treynor and Mazuy (1966) and Henriksson and Merton (1981).

To further improve the accuracy of asset pricing models and overcome the drawbacks of traditional factor models, a number of empirical studies have been conducted on testing the validity of various performance measures and improving the predictability of factor models by introducing various modifications into these models, for instance, changing them from unconditional to conditional and allowing time-varying beta (e.g. Ferson and Schadt, 1996), introducing new factors to capture different industry and country characteristics (e.g. Grinblatt and Titman, 1992; Gregory, Tharyan and Christidis, 2013), and establishing better multiple-portfolio benchmarks to measure managers' stock-picking skills, for instance, the eight-portfolio benchmark, non-benchmark performance measure (Grinblatt and Titman, 1993) and the characteristic-based benchmark model (Daniel et al., 1997). The most recent research interest has turned to econometric issues and the statistical inference generated through applying various statistical methods, for instance, bootstrap methods (e.g. Kosowski et al., 2006; Cuthbertson, Nitzsche and O'Sullivan, 2008; Fama and French, 2010). It is worth noting that the empirical results gained on manager skill depend crucially on different bootstrap methods apply (Blake et al., 2017). The bootstrap method employed by Kosowski et al. (2006) resamples residuals of each fund only while Fama and French (2010) employ an alternative bootstrap method that jointly resample the factor returns and the residuals for all funds. Recent research on mutual fund performance, performance persistence and flow-performance relationship tend to apply various measures to evaluate mutual fund performance (e.g. Sirri and Tufano, 1998; Del Guercio and Tkac, 2002; Goriaev, Nijman and Werker, 2008; Jones and Wermers, 2011; Ferreira et al., 2012) since although various performance measures have been proposed but no consensus has been reached on the question: which model is the most appropriate and suitable measure for mutual fund performance. While it is widely accepted that it is unclear what performance measures and time intervals are most salient, researchers tend to employ alternative measures and calculate performance over various time horizons mainly for robustness test (Sirri and Tufano, 1998; Goriaev, Nijman and Werker, 2008). Although a number of empirical studies have been conducted on mutual fund performance measures, we neither attempt to test the accuracy of these asset pricing models in calculating

mutual fund performance nor aim to develop a new performance measure in this thesis. Instead, we simply employ various factor models to measure fund performance and accept the risk-based interpretation of the alpha estimate. A detailed discussion of performance measures and bootstrap method that will be used in this thesis can be found in Chapter 4.

3.1.2 Mutual Fund Performance

There has been extensive research on mutual funds with a variety of different datasets, sample periods and methodology. Controversies exist on a series of research topics including fund performance, performance persistence and active fund manager ability. While underperformance of mutual funds and inferior manager ability have been broadly supported in existing research (e.g. Jensen, 1968; Malkiel, 1995; Gruber, 1996; Carhart, 1997; Blake and Timmermann, 1998), recent studies documenting superior performance of actively managed mutual funds (e.g. Moskowitz, 2000; Kosowski et al., 2006) deepens the controversy. The following sections will present the controversial findings and highlight important examples of research in this field.

As one of the earliest research on fund performance, Jensen (1968) studies the performance of 115 US open-end mutual funds from 1945 to 1964 by using annual data and risk-adjusted measure of performance, which is known as Jensen's alpha. He finds that on average, funds underperform the market no matter performance is measured by net returns or gross returns. He concludes that fund managers do not have superior ability to outperform passive benchmarks and any outperformance achieved is purely by luck. His findings are confirmed by several later studies (e.g. Shawky, 1982; Dunn and Thiesen, 1983).

Malkiel (1995) investigates the performance of US equity funds during the period 1972-1991 using a survivorship bias free dataset of quarterly returns. The comprehensive dataset allows Malkiel (1995) to examine the impact of survivor bias on fund performance. Surviving funds are found to consistently outperform the non-surviving funds and the difference in returns is observed to be substantial and statistically significant. Using the capital asset pricing model to estimate risk-adjusted returns, Malkiel (1995) discovers that on average, mutual funds underperform benchmark both before and after fees and expenses deducted, which is in accordance with Jensen (1968)'s results.

Gruber (1996) studies US actively managed open-end equity fund performance from 1985 to 1994 using various performance evaluation techniques including relative measures, Jensen's measure and a multifactor model that incorporates four variables, namely market risk premium, difference in return between small and large cap stocks, difference in return between growth and value stocks and bond return premium. He documents an inferior performance of active mutual funds compared to the market portfolio.

In one of the most influential papers, Carhart (1997) incorporates his four-factor model, which is developed on the basis of Fama and French (1992)'s three-factor model and creatively captures Jegadeesh and Titman (1993)'s momentum effect into the analysis of fund performance and performance persistence. He finds no evidence of managerial talent in the research. Expense ratio, transaction costs and load fees are proved to have direct and negative influence on mutual fund performance.

Among those studies documenting superior performance of actively managed mutual funds, Ippolito (1989) uses a dataset including 142 US mutual funds from 1965 to 1984 to test capital market efficiency and assess overall performance of the actively managed mutual fund. He aims at investigating whether active funds really add value and generate enough return to compensate for the higher fees charged. His results demonstrate significant superior returns generated by active management, which are sufficient to cover fee charges. This result is consistent with the concept of costly information raised by Grossman and Stiglitz (1980), who argues that completely informational efficiency is impossible to achieve, as investors who spend money on gathering information require compensation for the cost involved.

Grinblatt and Titman (1989a) study quarterly equity holdings of a sample of mutual funds over a sample period from 1975 to 1984 by employing Jensen's measure with four sets of benchmarks and find that growth funds achieve significantly superior performance when gross returns are utilized in analysis. However, no evidence of outperformance is obtained when net returns are used. Hence, they suggest that growth and aggressive growth funds outperform the market, but the superior performance is consumed by high expenses. Some later studies (e.g. Grinblatt and Titman, 1993; Grinblatt, Titman and Wermers, 1995; Wermers, 1997) also find evidence of superior performance generated by actively managed mutual funds. However, in most of these studies, positive alphas are exhibited when gross

returns of funds are applied, and the outperformance disappears after fees and expenses being deducted (e.g. Jones and Wermers, 2011; Blake et al., 2017).

Some researchers further investigate fund performance in different market conditions and put forward that the average underperformance of mutual funds documented in existing literature results from the significant negative alphas achieved in expansion rather than in recessions (Kosowski et al., 2006). Investors benefit more from active management during recessions and downturns when it matters most to investors. Concerning the controversy on fund performance and the question arising on whether active management really adds value especially in a downturn market, an increasing number of researchers pay special attention to the performance of actively managed funds relative to their passive peers. Proponents for the argument that active management adds value include Moskowitz (2000). Moskowitz (2000) finds that during 1975-1994, actively managed mutual funds beat CRSP value-weighted index by around 6 percent in the period of recession. This result holds for both net returns and gross returns. Recently, Kacperczyk, Nieuwerburgh and Veldkamp (2014) point out that fund manager skill shows time-varying characteristic as stock selection ability dominates during expansions while market timing ability is more pronounced during recessions.

While there is substantial evidence of underperformance in mutual fund from earlier research, the data, performance measures and statistical techniques employed always suffer from various critiques. In later studies, more comprehensive data and sophisticated methodology for measuring fund performance have been used, which significantly improve the reliability of results. Ferson and Schadt (1996) question the reliability of unconditional measures applied in early studies and propose conditional factor models that allow for time-varying factor betas and incorporate lagged instruments of publicly available information. They employ both unconditional and conditional measures to examine the performance of 67 US mutual funds over a sample period from January 1968 to December 1990. The results indicate that negative alphas in overall fund performance found by using unconditional measures turn to positive to some extent when predetermined lagged public information variables are included. They also extend the conditional factor models to include market timing measures proposed by Treynor and Mazuy (1966) and Henriksson and Merton (1981). According to Ferson and Schadt (1996), the unconditional market timing models provide biased estimation of managers' timing ability because even for the passive index portfolios, negative market timing is detected by employing unconditional measures. After the

conditional market timing measures are applied, market timing ability of fund managers improves. Therefore, they conclude that fund performance looks better and gains statistically and economically significance under conditional model.

Daniel et al. (1997) propose a characteristic-based benchmark method to investigate the performance of more than 2,500 US mutual funds during 1975-1994. Contrary to the underperformance of active mutual funds evidenced in most existing studies, they find active fund managers outperform the benchmark, showing stock-picking ability but no market timing ability. Nevertheless, the abnormal returns detected are relatively small and consumed by management fees. In addition, Daniel et al. (1997) also discover that among different types of mutual funds, growth-oriented funds consistently deliver superior performance. These results are confirmed by later studies including Hsiu-Lang Chen, Jegadeesh and Wermers (2000) and Wermers (2000). Hence, when there is no consensus on which performance measure is the most appropriate measure, it is necessary to apply alternative measures in our research to get robust results. Just as suggested by Jones and Wermers (2011), more extensive data and more robust analysis are preferable.

All the literature reviewed above uses standard conventional econometric and statistical techniques to gain inference on fund performance, in the studies conducted by Kosowski et al. (2006) and Fama and French (2010), bootstrap methods are applied to address the non-normality in alpha and persistence in luck. Thus, skilled managers can be distinguished from those who outperform because of luck from comparing the true distribution of alpha and t-statistic of alpha to the luck distribution of alpha and t-statistic of alpha obtained from the resampling procedure. Kosowski et al. (2006) identifies a small group of skilled managers by allowing for bootstrapped standard error for statistical inference. The results are robust to alternative factor models employed. However, using an alternative bootstrap method, which jointly resample the factor returns and the residuals for all funds rather than resample the residuals only for a single fund in Kosowski et al. (2006), Fama and French (2010) find contrary findings and conclude that no manager ability is detected.

It is worth noting that the database information utilized in mutual fund research is often truncated. The tendency to drop the record of poorly performed or closed mutual funds from the database can lead to distorted and inaccurate results as well as spurious conclusions. A number of studies have been carried out to address the survivorship bias issue (e.g. Grinblatt

and Titman, 1989a; Stephen J Brown et al., 1992; Malkiel, 1995; Elton, Gruber and Blake, 1996; Carhart, 1997; Carhart et al., 2002), which assert that most early studies on mutual fund performance are subject to survivorship bias and neglect of survivorship bias can lead to overestimation of returns and inaccurate results of performance related variables. Over the past 20 years, the literature on the performance of UK unit trusts is not as extensive as the studies on fund performance in a US setting. One possible reason might be that the construction and development of CRSP Survivor-Bias-Free US Mutual Fund Database facilitates researchers to carry out studies on US mutual fund industry with results not being distorted by potential survivorship bias. Nevertheless, in the UK, such a survivorship bias free database for UK open-end equity unit trusts/OEICs is not available. Commercial data providers such as Lipper and Morningstar mainly focus on providing information on potential investments that currently available in the market to their clients and tend to remove the records for those funds that once existed but have been merged or liquidated. Therefore, there are much fewer studies that have been conducted on UK mutual funds, as researchers have to make a lot of efforts to construct their own survivor-bias-free database for UK equity mutual funds.

Fletcher (1995) studies the stock picking and market timing ability of UK equity unit trust managers using a sample consisting of 101 randomly selected trusts that have a minimum of two years of continuous monthly data. The sample covers the period from January 1980 to December 1989. The models suggested by Henriksson and Merton (1981) and Carl R Chen and Stockum (1986) are employed to examine the performance of UK unit trusts. Various benchmark portfolios are tested to investigate if the results are robust to different benchmarks or market portfolios utilized in the single index model. Fletcher (1995) finds that the average UK mutual funds have positive stock picking skills and negative market timing skills. However, the statistical significant of fund performance is conditional on the benchmark portfolio used in the single factor model, the tests chosen to test market timing and the fund investment objectives. Fletcher (1997) extends the literature on UK unit trusts performance using the arbitrage pricing theory advocated by Ross (1976). After examining the same dataset utilized in Fletcher (1995), Fletcher (1997) finds no evidence of superior performance in UK unit trusts and observes that there is little relationship between fund performance and investment objective, fund size and expenses of a unit trust. The results are robust to various benchmarks employed.

Blake and Timmermann (1998) investigates a large dataset comprising monthly returns on a total of 2,300 open-ended UK unit trusts over a 281-month period from February 1972 to June 1995. 973 out of the 2,300 funds had been in existence over the sample period but was merged or liquidated before the end of the sample while another 1,402 funds survived at the end of the sample period. The dataset includes both surviving and non-surviving funds, and thus is a survivor-bias-free dataset, which allows the researchers to assess the impact of survivorship bias on fund performance and evaluate the performance of dead funds prior to their death as well as the performance of funds in the first year when they come into existence. Unlike most existing literature that focusing on domestic equity mutual funds only, the 20 sectors specified by the Association of Unit Trusts and Investment Funds and examined in this research includes not only domestic equity sectors such as growth, income and smaller companies, but also international equity sectors with specific geographical focus and some specialized sectors such as investment unit trusts. Using the survivor-bias-free dataset, Blake and Timmermann (1998) analyze the survivor premium and survivor bias across all funds and for each sector respectively. Over the sample period, the mean survivor premium across all sectors is found to be around 2.4% per annum while 16 out of 20 sectors show positive survivor premium. By employing an unconditional three-factor model, Blake and Timmermann (1998) report an average underperformance delivered by UK equity and balanced sector funds.

Quigley and Sinquefield (2000) study the performance of UK unit trusts with special focus on testing whether small-company unit trusts can beat the market. The dataset employed includes UK equity unit trusts only and comprises monthly returns on a total of 752 funds over a sample period of 20 years from January 1978 to December 1997. The dataset is a survivor-bias-free dataset as it consists of 479 surviving funds and 273 dead funds. Quigley and Sinquefield (2000) employ the single index model and Fama-French three-factor model to examine fund performance and finds an average underperformance of UK actively managed unit trusts on a risk-adjusted basis after fees deducted. They also detect that UK Smaller Companies funds do not consistently outperform the market benchmark and are the worst performing funds in their sample.

Like the majority of US studies on mutual fund performance, most UK literature on unit trust performance uses standard econometric techniques to compute standard errors and gain statistical inference, which might not be valid when individual fund returns are not normally

distributed as assumed. To address nonnormality in mutual fund returns and distinguish skilled fund managers from those fund managers who achieve superior performance by luck, Cuthbertson, Nitzsche and O'Sullivan (2008) use the bootstrap method employed by Kosowski et al. (2006) to examine the performance of a comprehensive sample of UK unit trusts. The survivor-bias-free sample tested consists of 842 actively managed UK equity unit trusts/OEICs and covers a period from April 1975 to December 2002. Cuthbertson, Nitzsche and O'Sullivan (2008) reports a negative but statistically insignificant risk-adjusted alpha for the average UK unit trust regardless of factor models utilized. In addition to examining the average performance across all funds, they also analyze the extreme tails of the distribution of alpha and distribution of t-statistics of alpha. Cuthbertson, Nitzsche and O'Sullivan (2008) finds that a relatively small number of UK fund managers have stock picking ability while in the left tail of the distribution, the underperformance of the worst performing funds is not merely due to bad luck but is attributed to bad skill. Cuthbertson, Nitzsche and O'Sullivan (2010a) further extend the literature on UK fund performance by testing the market timing skill of UK equity mutual fund managers. Different from the majority existing literature that uses the traditional regression-based methods of Treynor and Mazuy (1966) and Henriksson and Merton (1981), Cuthbertson, Nitzsche and O'Sullivan (2010a) apply the nonparametric method advocated by Jiang (2003) and find little evidence of private market timing ability that cannot be attributed to public information possessed by UK fund managers. Only a few equity income and general equity funds are observed to successfully time the market. The results are in general consistent with the findings of Fletcher (1995).

In a recent paper, Blake et al. (2017) attempt to gain new evidence on UK equity unit trust performance by employing alternative bootstrap methods. According to Blake et al. (2017), the bootstrap method utilized by Kosowski et al. (2006) implicitly assumes that the residuals are independent across different funds and the impact of common risks stay unchanged during the sample period. In contrast, Fama and French (2010) take both systematic and non-systematic risk into account in evaluating manager skills by jointly resampling with replacement the factor returns and the residuals for all funds. While Kosowski et al. (2006) find evidence of a small number of skilled managers, Fama and French (2010) draw a conclusion of no manager skills found. Thus, Blake et al. (2017) point out that it is important to identify whether the different results stem from the bootstrap methods applied or different dataset, inclusion criterion and simulation times applied. They compare the two bootstrap

methods using a survivor-bias-free dataset consisting of monthly returns on a total of 561 UK domestic equity mutual funds over the sample period from January 1998 to September 2008. They conduct analysis of manager skill on five subsamples, which are constructed by imposing inclusion criteria of at least 8, 15, 20, 40, and 60 consecutive monthly returns. The results are based on both net returns and gross returns. The alpha estimates that derived from unconditional Carhart four-factor model and total performance measure that captures both stock-picking skill and market timing skill suggest that on average, UK equity unit trust is unable to outperform the benchmark even before fund management fees are deducted. There exists a small group of skilled managers who have sufficient skill to deliver superior performance when the Kosowski et al. (2006) bootstrap is applied to gross returns. On the other hand, the findings obtained from employing Fama and French (2010) bootstrap method suggest that there is no evidence of outperformance delivered by UK fund managers irrespective of net returns or gross returns utilized. Blake et al. (2017) conclude that the assessment of fund performance and fund manager skill depends on the bootstrap methods used. They also point out that skilled managers who generate superior gross abnormal returns extract the all the abnormal performance through fee charges and investors are not better off investing in these funds.

In addition to the literature that focuses on evaluating fund performance using alternative performance measures to gain evidence on manager ability, there are some studies, which develop special interest in investigating the determinants of fund performance. Joseph Chen et al. (2004) tests whether fund size erodes mutual fund performance using a survivor-bias-free sample that includes 825 US equity mutual funds over the period 1962-1999. The results suggest that fund performance especially the performance of small cap funds declines as fund size increases controlling for various benchmarks and other fund characteristics such as fund age and turnover ratio. Specifically, one percentage point increase in fund size will lead to a decrease of about 0.003 percentage points in fund returns over the next 12 months. They attribute the observed negative relationship between fund size and performance to organizational diseconomies of scale pointed out by Stein (2002) as large funds are worse at processing soft information compared to small funds. Blake et al. (2014) confirms that there is an inverse relationship between lagged fund size and fund performance on a risk-adjusted basis using a sample of 561 UK domestic equity mutual funds over the period from January 1998 to September 2008. Their results are robust to various regression models employed that

accounts for fund and time effects. Reuter and Zitzewitz (2010) use a sample of monthly data on all mutual funds that were in existence from December 1996 to August 2009 in Morningstar database to examine the level of diseconomies of scale in mutual funds. Employing a regression discontinuity approach to address the bias of standard OLS estimates caused by the fact that fund size is endogenously related to future returns, Reuter and Zitzewitz (2010) find little evidence of negative relationship between fund size and future performance. In a recent paper, Pástor, Stambaugh and Taylor (2015) extend the literature on diseconomies of scale in asset management by testing fund-level decreasing returns to scale and industry-level decreasing returns to scale separately in terms of the nature of returns to scale in active management. They point out that when estimating the effect of fund size on performance, neglect of endogeneity of fund size might lead to wrong statistical inference. Size seems not randomly paired with funds. Larger funds might be run by more skilled managers, who in turn may bring in better performance and further expand fund size. To address omitted variable bias and finite-sample bias in traditional regression-based methodology, Pástor, Stambaugh and Taylor (2015) employ the recursive demeaning approach to analyze the relationship between fund size and expected returns. They find strong evidence of industry-level decreasing returns to scale, which explains the observed deterioration in performance over a fund's lifetime but insignificant diseconomies of scale using the recursive demeaning approach though traditional regression-based methods indicate a significant negative relationship between fund size and performance.

Ferreira et al. (2013a) conduct a cross-country study to identify the determinants of actively managed mutual fund performance. The survivors-bias-free dataset includes a total of 16,316 open-end active mutual funds from 27 countries after excluding off-shore funds, closed-end funds, index and tracker funds, ETFs, and fund of funds and imposing an inclusion criterion of having a return history of at least two years. The comprehensive dataset contains both domestic and international funds with information on their geographic investment focus available. The findings suggest that a variety of fund characteristics including fund size, fund family size, fund flows, past performance, management structure and number of countries where a fund is sold as well as country characteristics have impact on future fund performance. However, there are significant differences in the variables that affect fund performance in the US and other areas in the world. The observed decreasing returns to scale in US mutual funds does not apply to funds domiciled outside the US and funds diversifying

overseas. Ferreira et al. (2013a) argue that the negative relationship between fund size and performance in the US is related to liquidity constraints and the limited domestic investment opportunity.

Literature on international equity mutual funds is not as extensive as on domestic equity mutual funds (e.g. Cumby and Glen, 1990; Gallo and Swanson, 1996; Turtle and Zhang, 2012). The evidence on whether international equity mutual funds can deliver superior performance is also mixed. Eun, Kolodny and Resnick (1991) use a sample of 19 international funds over the sample period from 1977 to 1986 to assess the performance of US-based international mutual funds. They find that international mutual funds beat the S&P 500 Index but do not outperform the MSCI World Index. Cumby and Glen (1990) examine the performance of 15 US-based international mutual funds over the period from 1982 to 1988 using Jensen's alpha and positive period weighting measure employed by Grinblatt and Titman (1989b). They find that neither individual international funds nor all international funds as a whole outperform a broad market index. The superior performance observed for international funds relative to the Morgan Stanley index for the US is probably due to diversification benefits rather than manager skill.

Gallo and Swanson (1996) compares the performance of 37 US-based international mutual funds over the sample period 1985-1993 assessed using an international two-index model and an international arbitrage theory two-factor mode. They find that the performance evaluation and relative performance ranking depends crucially on the measurement models employed. No superior performance is observed based on the index model while evidence of superior performance is documented when international APT model is applied. Using a sample of 35 actively managed international mutual funds over the sample period from January 1985 to March 1994, Detzler and Wiggins (1997) evaluate the performance of international mutual funds. The dataset suffers from survivorship bias though the impact is small. The findings suggest that all the 35 international funds as a whole beat the inefficient world index while the results based on a 12-country benchmark indicates no stock picking skill. These results hold irrespective of performance measures employed.

Redman, Gullett and Manakyan (2000) use a sample of 78 international mutual funds to examine whether international mutual funds can outperform the benchmark over the sample period 1985-1994. Five portfolios of international funds are constructed to be measured

against two benchmarks: the Vanguard 500 Index and a portfolio that includes US domestic equities only. They find mixed evidence on international fund performance over different time periods. The international funds outperform the benchmarks over the whole sample period when Sharpe's Index and Treynor's Index are utilized to measure performance. Over the early sample period from 1985 to 1989, international mutual funds deliver superior performance while the index funds show outperformance during the later period 1990-1994.

Using a large dataset that includes 831 international funds over the sample period from 1976 to 2000, Fortin and Michelson (2005) examine whether active management of international funds adds value. They find that actively managed international mutual funds outperform their matching index funds, except for Europe funds. The superior performance is significant enough to conclude that investors can benefit from active international fund management. Fortin and Michelson (2005) also study the determinants of international fund performance. In contrast to most existing evidence on domestic mutual funds, the total return of international funds is not affected by expense ratio but positively related to turnover and fund size. Recently, evidence of negative abnormal returns generated by US-based international and global mutual funds after controlling for regional exposure is found by Comer and Rodriguez (2012) and Tsai and Wu (2015) using international and regional factor models.

For the UK-based international unit trusts, Fletcher and Marshall (2005a) examine the performance of a dataset consisting of 282 UK mutual funds with international investment objective over the sample period from 1985 to 2000 using the international version of Carhart four-factor model. They find little evidence that international unit trusts outperform the benchmark and point out that the results are significantly affected by the choice between global factors and local factors utilized in the Carhart model. Employing the same dataset, Fletcher and Marshall (2005b) assess the performance of UK-based international funds using alternative performance measures, which include modified Jensen (1968) and Ferson and Schadt (1996) measures with an international benchmark as well as the law of one price (LOP) measure employed by Zhiwu Chen and Knez (1996). They find little evidence that international unit trusts generate superior abnormal returns. The results are robust to alternative performance measures applied though performance evaluation of international mutual funds is found to rely on performance measures. In most cases, less favorable performance is documented under the LOP measure. Fletcher and Marshall (2005b) also find there is a negative relationship between fund size and performance of international unit trusts.

Besides, the charges and investment sector also have impact on performance especially when the LOP measure is utilized.

3.2 Performance Persistence

3.2.1 Berk and Green (2004) Equilibrium Model

An important reason for investors to chase past performance is that they base their investment decisions on manager skill learned from past fund manager performance and expect the positive abnormal returns will persist into the future. However, most early studies that aim at validating efficient market hypothesis and empirically testing whether the active management adds value find no evidence of persistence in fund performance.

Berk and Green (2004) propose a rational model to explain the lack of persistence in mutual fund performance. The model works based on the idea raised by Grossman and Stiglitz (1980) that gathering and processing information is costly and the assumption that there exists differential ability to achieve superior gross performance across mutual fund managers. According to Berk and Green (2004), informed investors chase past performance and learn about managerial skills, which were unknown to both managers and investors by observing historical returns. Investors direct money into funds that have outperformed and punish funds that have underperformed by withdrawing money. The flow-performance relationship is nonlinear as the top performers attract disproportionately more fund inflows as investors compete with each other to invest in the top performers with the expectation to obtain abnormal returns. However, the persistent outperformance would be competed away by fund inflows, which function as an equilibrating mechanism because of decreasing returns to scale. In Berk and Green (2004) model, a critical assumption is that mutual fund managers operate at decreasing returns to scale. When mutual funds grow too large, the information gathering capacities of fund managers will be spread too thinly and the trading activities will have a greater price impact on the underlying assets and incur higher costs. Thus, it is difficult for past winners to maintain their superior performance in long term and in equilibrium, any profits and abnormal returns will be eliminated.

3.2.2 Persistence in Mutual Fund Performance

Research on persistence in mutual fund performance directly contributes to the validity of the EMH and provides important evidence on the ability of active managers who are expected to consistently outperform the market to attract new investments. Literature on performance persistence in mutual funds is extensive and contradictory findings have been documented in previous studies.

Studies on performance persistence present inconsistent evidence from the very beginning. Sharpe (1966) finds a positive but not significant correlation in two ranking periods and conclude that past performance has some predictive power over future fund returns while Jensen (1968) find no evidence of performance persistence by applying Jensen's measure. Jensen (1968)'s finding advocates Efficient Market Hypothesis and are verified by most early empirical studies.

Grinblatt and Titman (1992) examine the persistence of mutual fund performance using a sample of 279 US mutual funds surviving from December 1974 to December 1984. The dataset is not survivorship bias free as it excludes funds terminated before December 1984. According to Grinblatt and Titman (1992), the survivorship bias should make it more difficult to find positive performance persistence as the non-surviving funds excluded are the worst performing funds, which are expected to perform poorly in the subsequent period. Using an eight-portfolio benchmark that is constructed to measure risk-adjusted performance and accounts for fund characteristics such as fund size and dividend yields, Grinblatt and Titman (1992) find significant evidence of performance persistence and attribute the observed performance persistence to the managerial talent of fund managers.

Among those researchers who document persistent pattern in fund performance, Hendricks, Patel and Zeckhauser (1993) identify a 'hot hands' phenomenon that top-performing funds show positive short-run persistence in performance by analyzing performance persistence for 165 growth-oriented mutual funds over the sample period from 1974 to 1988. The fact that mutual funds with better past performance in the most recent year continue to deliver superior returns is confirmed by Goetzmann and Ibbotson (1994). They document significant performance persistence among the top performers and point out that persistence is stronger for the best and worst performing funds. In addition to observing better performance and pronounced performance persistence among momentum investors, Elton, Gruber and Blake

(1996) document both short-term and long-term performance persistence during 1977-1993 after controlling for survivorship bias and applying risk-adjusted return into analysis.

Malkiel (1995) analyzes the performance of all equity funds sold to the public from 1971 to 1991 and observes a significant persistent pattern in US equity mutual fund performance in 1970s utilizing the two-way contingency tables employed by Goetzmann and Ibbotson (1994). The results are robust when ranking and evaluation period ranges from one quarter to two years and whether total returns or risk-adjusted returns are utilized to conduct the analysis. However, the strong persistence phenomenon documented in 1970s disappears during 1980s. Significant reversals in performance are observed in the second ten years. These findings further complicate the academic view on performance persistence in mutual funds.

Stephen J Brown and Goetzmann (1995) examines the performance persistence using a largely survivorship bias free dataset of annual data on US equity mutual funds over the sample period 1976-1988. They find performance persistence in poorly performing funds and point out that fund performance is sensitive to the time period examined.

Carhart (1997) finds little evidence of performance persistence after applying his four-factor model to measure risk-adjusted performance. He summarizes that the one-year performance persistence or 'hot hands' phenomenon can be explained by common factors in stock returns, the momentum effect and expenses. The only puzzle left that requires further investigation is the long-term performance persistence in the worst performing mutual funds. Daniel et al. (1997) confirm that after the momentum effect being controlled, the persistence in mutual fund performance disappears.

Recently, more sophisticated statistical techniques and alternative performance measures were employed in studies on performance persistence as some studies suggest that the methodology used to rank funds plays an important role in examining performance persistence (e.g. Bollen and Busse, 2005). Misestimation of performance persistence may occur when no time-varying components are allowed in performance measures. According to Budiono and Martens (2009), performance persistence is overestimated in Fama-French model and underestimated in Carhart model. Then, Kacperczyk, Sialm and Zheng (2008) introduce a new performance measure 'return gap' and suggest that the impact of fund

managers' unobserved actions are persistent in the long-term on both the best and worst performing funds.

With respect to literature on persistence in UK fund performance, Blake and Timmermann (1998) investigate performance persistence using a sample of 814 UK mutual funds over the period from February 1972 to June 1995. They employ the recursive portfolio approach and rank funds based on their abnormal returns over the prior 24 months before a one-month evaluation period. Some evidence of positive performance persistence is gained from their analysis. Quigley and Sinquefield (2000) also analyze performance persistence using recursive portfolio approach. Their analysis is based on both raw returns and risk-adjusted returns derived from CAPM and Fama and French three-factor model. Evidence of performance persistence is gained when performance is measured by raw returns. While there is little evidence of performance persistence in the top performing funds based on risk-adjusted returns, the underperformance of the worst performing funds is found to persist to some extent.

Fletcher and Forbes (2002) explore performance persistence in UK equity unit trusts using a sample of 724 funds over the period from January 1982 to December 1996. Both contingency tables and recursive portfolio approach are employed in their analysis of performance persistence. Evidence of significant persistence is found using contingency tables irrespective of performance measures used. Fletcher and Forbes (2002) also observe persistent patterns in performance using recursive portfolio approach when analysis is based on abnormal returns from a single index model. After applying Carhart four-factor model, more reversals in performance are detected and performance persistence disappears.

Although Cuthbertson, Nitzsche and O'Sullivan (2008) mainly aim at examining the performance of UK unit trusts and distinguishing between skill and luck in fund performance using bootstrap method, they also test performance persistence in their survivor-bias-free sample consisting of 675 actively managed UK equity unit trusts/OEICs over the sample period from April 1975 to December 2002 using a recursive portfolio approach. Funds are ranked into quintiles based on the t-statistics of alpha derived from prior 60 months of returns. Cuthbertson, Nitzsche and O'Sullivan (2008) find no evidence of performance persistence in past winner funds but some evidence of persistence in the worst performing funds. The results are robust to rebalancing periods of 1, 3, 6, 9 and 12 months.

While the persistence in domestic mutual fund performance has been extensively investigated, there is limited evidence gained on performance persistence international mutual funds over the past 20 years. Droms and Walker (2001) empirically test the persistence in international mutual fund performance using a dataset comprising annual returns and fund characteristics data on 151 equity mutual funds over the sample period from 1971 to 1990. Both long-term and short-term persistence are tested using the regression-based approach adopted by Grinblatt and Titman (1992) and contingency tables employed by Stephen J Brown and Goetzmann (1995). Droms and Walker (2001) find little evidence of long-term persistence in fund performance controlling for fund size. The results suggest that fund size is not related to the performance of international mutual funds. However, there is significant evidence of short-term performance persistence over one, two and three years.

Fan and Addams (2012) study the performance and performance persistence of US-based international mutual funds using a sample of 117 equity mutual funds with international investment objective over the period from 2005 to 2009. They find some evidence of superior performance under alternative performance measures including total returns, Sharpe ratio, fund alpha and Morningstar rating. The results suggest that fund size is positively related to future performance because of economies of scale and skilled managers. Consistent with the majority of literature on fund performance, little evidence of performance persistence in international mutual funds is discovered using the contingency tables. By contrast, Breloer, Scholz and Wilkens (2014) find inferior performance of international mutual funds on a risk-adjusted basis using alternative factor models and attribute the performance persistence of international mutual funds to repeated loser funds.

Whilst the main motivation of Busse, Goyal and Wahal (2013) is to assess the performance of active retail and institutional US-based international equity mutual funds and distinguish between skill and luck for fund performance, they also analyze the performance persistence in active international funds using a sample consisting of 1,218 institutional funds and 1,019 retail funds over the sample period from 1991 to 2009. Busse, Goyal and Wahal (2013) find little evidence of superior performance for average international fund managers but some evidence of superior selectivity ability in the extreme right tail of the distribution of t-statistics of alpha. After applying the recursive portfolio approach, Busse, Goyal and Wahal (2013) find some evidence of short-term performance persistence but no evidence of persistence in fund performance longer than one year.

3.3 Fund Flows

A main objective for fund management is to attract new investments and the best performing funds are more likely to pool a large amount of cash. However, the profitable investment opportunities are limited, which might result in poorer performance in the subsequent period for funds receiving large net cash inflows. Therefore, the flow-performance relationship could be viewed as a two-step process. The literature on fund flows falls into two categories:

1) Investigating the impact of past performance on subsequent fund flows.
2) Examining the influence of fund flows on future performance.

Most studies in this field focus on one aspect of the complete two-step flow-performance relationship, especially the relationship between past performance and future fund flows. More recently, motivated by the Berk and Green (2004) model of fund flows, research interest has turned to study the impact of fund flows on subsequent fund performance. The majority of studies on flow-performance relationship have been conducted in a US setting. Limited evidence on the relationship between fund flows and performance has been gained for UK equity unit trusts especially UK international equity unit trusts. In this thesis, we will examine both aspects of the complete flow-performance relationship. The relationship between subsequent fund flows and past performance for UK unit trusts using regression-based approach will be established first. Then the empirical test of Berk and Green (2004) model using recursive portfolio approach that incorporates fund flows will be conducted.

3.3.1 Future Fund Flows and Past Performance

The positive relationship between subsequent fund flows and past performance has been widely observed in empirical studies (e.g. Ippolito, 1992). The research carried out by Sirri and Tufano (1998) is among the earliest studies on flow-performance relationship. They mainly focus on examining the impact of past performance on future fund flows as well as the implication of costly search. They analyze a large sample containing information on 690 mutual funds over the period 1971-1990 and employ a regression-based model to analyze the determinants of future fund flows as well as the sensitivity of the flow-performance relationship to variables related to costly search including marketing expense and fund family size. The results indicate that investment decisions of individual investors are based on past performance and funds asymmetrically flow to the best performing mutual funds but fail to

flow out of poorly performing funds. Besides, investors prefer small and less risky funds with lower fee charges. The convex flow-performance relationship is also confirmed by Del Guercio and Tkac (2002), Barber, Odean and Zheng (2005), Lynch and Musto (2003), Elton, Gruber and Busse (2004), Bollen (2007) and Jennifer Huang, Wei and Yan (2007).

Del Guercio and Tkac (2002) study the determinates of fund flows into US retail mutual funds and fiduciary pension funds and find a significant relationship between subsequent fund flows and past performance. Differences in the shape of flow-performance relationship between mutual funds and pension funds are also observed. Compared to mutual fund investors, pension fund investors are more likely to punish the worst performing funds by withdrawing money and less likely to invest disproportionally more money in past winners.

Barber, Odean and Zheng (2005) apply Fama-Macbeth rolling regression approach to analyze flow-performance relationship as well as the impact of different fees on future fund flows. They document a positive relation between subsequent fund flows and past performance as well as greater sensitivity of fund flows to visible fees such as advertising expenses and commissions. Jain and Wu (2000) further argue that outperforming funds with higher advertising expenses experienced more cash inflows, which is consistent with Sirri and Tufano (1998) who assert that higher advertising expenses reduce investors' searching cost for well performing funds. These studies are extended to investigate the determinants of the convexity of flow-performance relationship by Jennifer Huang, Wei and Yan (2007). They show that the slope of flow-performance relationship is determined by participation costs including expense ratios, load fees, fund family. High participation cost result in more sensitive flow-performance relationship for funds in the high performance range but leads to less sensitive fund flows to past performance for funds in the median performance range.

Goriaev, Nijman and Werker (2008) study flow-performance relationship from the perspective of performance dissemination in the mutual fund industry from 1991 to 2005. They document a 'hump-shaped lag pattern' for flow-performance relationship, which means that investors were more sensitive to information disseminated six months ago rather than more recently. The results suggest that this pattern is strong for all funds in the 1990s but gradually disappear after 2000 as investors rely more heavily on very recent information to make investment decisions. However, the hump-shaped pattern still exists among highly marketed mutual funds. Berkowitz and Kotowitz (2000) also examine the sensitivity of future

fund flows to the lag structure in past performance using a sample of quarterly data over the period from 1981 to 1993 and find that investors are more sensitive to most recent performance information. Cashman et al. (2014) compare the flow-performance relationship across fund types and find that the impact of monthly performance on future fund flows lasts for up to twelve months for US domestic equity mutual funds while the effect of past performance on international mutual fund money flows is more short-lived, which lasts for only one or two months.

In contrast to the empirical evidence for positive relation between fund flows and past performance, Warther (1995) find no relationship between fund flows and past performance at a macro level. He divides fund flows into anticipated and unanticipated flows and finds that returns positively respond to unexpected flows. With respect to the flow-performance around the world, Ferreira et al. (2012) conduct a cross-country study on the relationship between fund flows and past returns. They find that there are significant differences in the flow-performance relationship across countries. Empirical evidence on US mutual funds cannot be generalized to other countries. In developed countries, the flow-performance relationship is more linear since the investors are more sophisticated and participation cost is much lower.

While most literature focus on the convexity of flow-performance relationship and the impact of non-performance variables such as fees, expenses and fund size on flow-performance relationship, quite few research pays attention to the flow-performance relationship and sensitivity change during 2008 financial crisis, which is the one of the main research aims of this study.

Few studies on international equity mutual funds pay attention to the flow-performance relationship in actively managed international mutual funds. Zhao (2008) carry out a research that focuses exclusively on flow-performance relationship in international equity mutual funds using a survivor-bias-free sample that includes 1,603 open-end international equity funds over the period from 1992 to 2001. In addition to establishing flow-performance relationship, Zhao (2008) also examined the impact of variables including risk, expense, turnover ratio, number of investment objectives offered by fund family, change in exchange rates, correlation with domestic markets and regional diversification on future fund flows amongst US-based international equity mutual funds. Zhao (2008) confirms that international fund investors show return-chasing behavior and find that they pay more attention to risk-

adjusted return than raw returns as international fund investors are better educated and more sophisticated. However, unlike domestic fund investors, international fund investors concern little about expenses. International equity funds, which are not highly correlated with US markets, less regionally focused and from fund families offering more choice of investment objectives, receive higher inflows. The results suggest that change in exchange rate do not have significant impact on future fund flows. It is not consistent with the findings of Adams and Hartsfield (2010), which suggest that both change in exchange rates and the associated volatility play an important role in determining money flowing in and out of US-based international equity mutual funds. Adams and Hartsfield (2010) report a significantly negative relationship between subsequent fund flows and recent one-year fund performance. This negative relationship reverses when performance is measured over longer term, for instance, 3 years.

Patro (2010) examines the determinants of fund flows into US-based international mutual funds with a comprehensive survivor-bias-free dataset consisting of 2,412 international funds that invest in non-US countries and 10,019 US domestic equity mutual funds over the sample period from January 1962 to December 2003. The results are consistent with the well-documented return chasing behavior that exists in international fund investors. A strong relationship between fund flows into international mutual funds and the correlation between international fund returns and the US market returns is observed. The flow-performance relationship is even stronger when international asset returns are less correlated to the returns on the US market portfolio, which is consistent with the objective of international investments, global diversification. Patro (2010) also finds that there is a preference of domestic funds among US investors, which can be attributed to the home bias.

Amongst studies concentrating on fund flows to emerging market equity funds, Kaushik (2012) analyzes 56 US domiciled funds with primary investment orientation in emerging markets and documents superior performance of emerging market funds. He finds that shareholders of emerging market funds might not be sophisticated enough as they simply chase past winners. Fund flows show a significant persist pattern as monthly flows are largely affected by prior month flows and performance. Consistent with Zhao (2008), Kaushik (2012) find no evidence of significant effect of fees and loads on fund flows. However, the results suggest that fund size and diversification are prominent determinants of future fund flows and investors' decision in investing in emerging market funds.

Busse, Goyal and Wahal (2013) study US-registered international equity mutual funds and find that despite of no abnormal returns achieved by the average international equity mutual funds, similar to domestic fund investors, international fund investors chase past performance. Prior performance is an important determinant of future cash flows in and out international equity mutual funds. This return chasing behavior is more prominent for global and developed institutional funds as well as emerging market retail funds but much weaker for emerging market institutional funds. Besides, fund flows show a stronger persistent pattern among retail investors than institutional investors. The widely documented convex flow-performance relationship also presents in both institutional and retail international equity mutual funds. It is worth noting that institutional investors invest disproportionally more funds into underperformed emerging market funds.

3.3.2 Past Flows and Future Performance

Controversy exits on whether large fund inflows will lead to subsequent inferior performance and the lack of performance persistence. Berk and Green (2004)'s prediction has been confirmed by several empirical studies including Berk and Tonks (2007) and Bessler et al. (2010) but challenged by the smart money effect proposed by Gruber (1996).

Edelen (1999) documents a negative relation between past fund flows and subsequent mutual fund performance. He also argues that the indirect cost for liquidity-motivated trading activities would result in lower fund performance in mutual funds as well as negative market timing ability of fund managers. Therefore, excessive inflows as well as outflows are equally harmful to short-term performance. Pollet and Wilson (2008) also report that fund inflows lead to subsequent underperformance in mutual funds. They argue that the best investment opportunities are limited. As money inflow increase, the managers will compete to acquire the best investment opportunities, and as a result, incurring a higher cost. Thus, in the subsequent period, the returns will be lower for those funds experiencing large amount of cash inflow.

Berk and Tonks (2007) examine a large sample of 9,830 US equity mutual funds over 1962 to 2004 and suggest that the long-term performance persistence in the worst performing mutual funds observed by Carhart (1997) can be explained by investors being reluctant to withdraw money from the worst performing funds. Bessler et al. (2010), alternatively, attempt to explain the lack of long-term performance persistence in actively managed mutual funds by

fund flows and manager changes. Their results are consistent with Berk and Green (2004)'s prediction. They find that fund flows and manager changes are important in determining future performance and explaining performance persistence. Best performing funds that attract large net money inflows generate negative, though insignificant risk-adjusted performance while winner funds without large amount of money injection achieve a higher subsequent performance. On the other hand, the worst performing funds that experience net outflows outperform the loser funds that suffer from net money inflows.

Rakowski (2010) point out that outflows can be as harmful as inflows since funds experiencing volatile flows tend to underperform those funds with more steady flows. It is consistent with Coval and Stafford (2007), which suggest that substantial outflows trigger liquidity-motivated trading, which might worsen fund performance and introduce higher transaction costs for those loser funds.

In contrast to the prediction of Berk and Green (2004), Gruber (1996) suggest that there is a positive relationship between fund flows and subsequent performance due to smart money effect. According to Gruber (1996), managerial ability, which is not priced when investors buy and sell fund shares at net asset value, indeed exist and can be detected by some investors. These informed investors have the ability to identify fund managers with superior ability and predict future fund performance. Therefore, new investments flow into mutual funds would achieve superior performance in the subsequent period. After analyzing the returns on newly invested money in 227 mutual funds during 1985-1994, Gruber (1996) conclude that the risk-adjusted return on funds receiving new investments would be higher than the average return on the funds. He suggests that this is the "smart money effect", which advocates that investors have the ability to choose outperforming funds.

The evidence on smart money effect is mixed. Zheng (1999) extends Gruber (1996)'s research to investigate investor's ability to select outperforming funds. Utilizing a sample containing all equity mutual funds over the period 1970 to 1993 and employing non-benchmark performance measure as well as conditional performance measures, which allow for time variation on mutual fund risks, to measure performance of different trading strategies, Zheng (1999) reports that mutual funds with more money inflows perform better than those experiencing money outflows in the subsequent period. However, the detected smart money effect is short-lived and not fully explained by different trading strategies.

Therefore, investors should not expect to receive abnormal return by analyzing past fund flow information expect for small funds.

Sapp and Tiwari (2004) suggest that the smart money effect documented by Gruber (1996) and Zheng (1999) can be explained by momentum effect. They employ Carhart's four-factor model to control for the momentum effect. After studying the performance of all US domestic equity funds during 1970-2000, the evidence for smart money effect is only found when momentum effect is not controlled in the performance measurement model. After controlling for momentum, the smart money effect disappears. Besides, they suggest that investors only respond to past performance and show little selectivity ability. Although no evidence of smart money effect is found in US funds, Ferreira et al. (2012) document a smart money effect in non-US funds.

It is interesting that the limited evidence from countries other than the US generally advocated smart money effect. Keswani and Stolin (2008) investigate the smart money effect in the UK mutual fund market through a detailed analysis of fund inflows and outflows in both individual and institutional investors. Using a sample consisting of nearly 500 funds and covering the period 1992-2000, they find that smart money effect is strong in both individual and institutional investors.

Recently, Fama and French (2010) argue that Berk and Green (2004)'s predictions should be theoretically rejected. According to Fama and French (2010), no funds can outperform the market and thus investors could not find funds with positive alpha before costs and fees deducted. This argument is essentially against any models or predictions for flow-performance relationship, which assumes that managers' ability exists, and active management adds value, including smart money effect. However, the mixed evidence presented, and limited research conducted on UK domestic and international mutual funds motivates in-depth research into this issue.

Chapter 4 Methodology and Data

4.1 Methodology

4.1.1 Mutual Fund Performance

Recent research applies various measures to evaluate mutual fund performance (e.g. Sirri and Tufano, 1998; Del Guercio and Tkac, 2002; Kosowski et al., 2006; Cuthbertson, Nitzsche and O'Sullivan, 2008, 2010b; Ferreira et al., 2012). Each performance measure has its own merits and drawbacks, shows different explanatory power over the cross-sectional variation in fund return and captures different aspects of manager ability. It is quite normal that different performance measures result in different performance rankings and different conclusions on the issues we investigate drawn. While some argue that conditional performance measures have the strongest explanatory power, it is widely accepted that it is unclear what performance measures and time intervals are most salient to investors (Sirri and Tufano, 1998). Therefore, alternative performance measures and time intervals should be employed for robustness purpose.

Blake and Timmermann (2003) justify the use of risk-adjusted returns in the analysis of fund performance, performance persistence and manager skill. They argue that without risk adjustment in the performance, mutual funds are more likely to be ranked according to their level of risk rather than the level of manager ability in performance persistence studies. Whilst riskier funds are more likely to deliver better performance, the statistical inference based on raw returns can mislead investors to invest in mutual funds with high risk and avoid holding mutual funds with low risk, which is not in the best interests of investors, especially those who are risk averse. Besides, a high-risk strategy hardly requires any manager skills to replicate and implement, which means the analysis of fund performance and performance persistence in terms of raw returns is unable to help investors identify active managers with superior ability. Hence, Blake and Timmermann (2003) conclude that it is necessary to base performance analysis on risk-adjusted returns and provide investors with reliable information on consistent underperforming mutual funds as well as less persistent outperformers to allow them to adjust their investment strategies accordingly. Jones and Wermers (2011) also advocate that past performance should be properly adjusted by using factor models. Del

Guercio and Tkac (2002) point out that in addition to raw returns, investors indeed take risk-adjusted performance measures into account when they make investment decisions and they show great concern on whether active management can add value as well as the magnitude of value added. They suggest that Jensen's alpha only significantly impacts fund flows of outperforming funds. It is consistent with the findings reported by Sirri and Tufano (1998) and Fant and O'Neal (2000) who showed that new investments disproportionally flow into top performers measured by Jensen's alpha. Therefore, instead of simply calculating accumulated returns, it is important to correctly measure the abnormal return achieved as well as identify outperformed managers. Besides, not only different performance measures but also different performance quintiles matter in the study on flow-performance relationship to test whether a convex flow-performance relationship holds for the sample.

What time horizon over which performance measures are calculated is another issue that needs to be taken into consideration in the analysis of performance persistence and the fund flow-performance relationship (e.g. Sirri and Tufano, 1998; Carpenter and Lynch, 1999). Short-term persistence in fund performance has been widely documented and explained by one-year momentum in stocks while long term persistence in the worst performing funds has also been found in recent studies and attributed to investors' unwillingness to withdraw money to punish past losers (e.g. Jegadeesh and Titman, 1993; Carhart, 1997; Berk and Tonks, 2007; Cuthbertson, Nitzsche and O'Sullivan, 2008, 2010b; Busse, Goyal and Wahal, 2013). Therefore, performance persistence tests are normally conducted over various holding periods ranging from 1 month to 5 years. Goriaev, Nijman and Werker (2008) argue that the majority of research calculates performance over a certain time horizon, which cannot capture the impact of different lagged returns on flow-performance relationship. Past performance has been measured over both short term and long term in a number of studies on flow-performance relationship for robustness (Sirri and Tufano, 1998; Jennifer Huang, Wei and Yan, 2007). Therefore, in addition to employing alternative performance measures, we will calculate fund performance over various time horizons and include different lags into our study to capture the lag pattern for the response of subsequent flows to past performance[4].

[4] Normally, the time horizons over which fund performance is measured range from as short as 1 month to as long as 5 years (Sirri and Tufano, 1998; Goriaev, Nijman and Werker, 2008) depending on the research aim and objectives. In this research, we will measure fund performance over different time horizons ranging from 1 month to 3 years depending on the research questions we study.

Although factor models are also widely used to measure the performance of international mutual funds, one challenge for evaluating international fund performance is the lack of appropriate benchmarks as well as a common set of factors to explain the cross-section of returns (Fan and Addams, 2012). Therefore, most early research on international equity mutual funds measure performance using long-term returns such as three-year or five-year raw returns, sharp ratio, performance ratings. World index such as MSCI World, MSCI EAFE, MSCI All Country World, FTSE All-World are common benchmark for global market returns. However, Fama and French (1998) point out that international CAPM fail to explain global value and growth portfolios and propose an alternative two-factor model with an international version of value factor. Griffin (2002) further examines the explanatory power of country-specific and international version of Fama-French three-factor model and conclude that none of these models can fully capture the time-series variation in returns. However, he demonstrates that Fama and French three-factor model performs better in a within-country context than a global context. Domestic version of three-factor model is superior to the international version of three-factor model in explaining average stock returns (Griffin, 2002). Hou, Karolyi and Kho (2011) examines the fundamental factors that explain common variation in international equity returns and confirm that momentum and value factors together with a global market risk factors can capture much of the variation in both country and global stock returns. Fama and French (2012) extend Griffin (2002) and Hou, Karolyi and Kho (2011)'s work using a larger sample covering 23 developed countries to examine whether the size factor together with value and momentum factors have explanatory power over cross-section variation in stock returns. As suggested by Fama and French (2012), both three-factor and four-factor model are motivated by empirically observed patterns rather than underlying economic models. They argue that if the explanatory portfolio returns can fully capture the cross-section variation in returns, the true intercepts for all explained portfolios or stocks should be zero. Besides, they also mention that possible failure of global asset pricing model might be due to lack of asset pricing integration across regions. The findings provide evidence on asset pricing integration within a region, which means local version of three-factor and four-factor models for each of the four regions identified do well in explaining average returns while global versions of CAPM, three-factor, four-factor models show poor explanatory power on local average returns. Therefore, they suggest that global factor models

can be applied to evaluate the performance of mutual funds diversifying globally rather than having strong regional orientation.

Just like the long-term controversy on the right asset-pricing model, there is little consensus on the correct way to construct regional and global risk factors for performance measurement (Busse, Goyal and Wahal, 2013). The key issue is the choice of breakpoints for factor portfolios. One can use either country-specific breakpoints (e.g. Fama and French, 1998; Griffin, 2002; Ferreira et al., 2012; Busse, Goyal and Wahal, 2013) or global breakpoints to construct factors (Hou, Karolyi and Kho, 2011). When utilizing country-specific breakpoints to construct region factors, market, size, value and momentum factors are first constructed for each country, and then take value-weighted average across all countries in the region for each factor to arrive at region factors.

It is worth noting that most tests of international asset pricing models (e.g. Fama and French, 1998; Griffin, 2002; Hou, Karolyi and Kho, 2011; Fama and French, 2012; Busse, Goyal and Wahal, 2013) ignore exchange rate risk. Fama and French (2012) point out that exchange rate risk might cause potential problem in the analysis. Since most literature on international mutual fund performance and performance persistence chooses to study US-based international equity mutual funds because of the existence of the largest and mature fund market in the US and easy access to CRSP survivorship bias database. Therefore, all returns are translated to US dollars rather than in local currency when constructing factors. Some studies suggest using local currency when constructing country specific factors to reduce the impact exchange rate fluctuations (e.g. Ferreira et al., 2012). Other researchers insist that exchange rate risk should be taken into account when measuring performance of international equity mutual funds (Stulz, 1981; Solnik, 1997). Dumas and Solnik (1995) and Zhang (2006) empirically test the contribution of exchange risk premium to international portfolio returns and confirm that exchange rate risk is significantly rewarded by using conditional models allowing for time-varying betas and risk premiums.

4.1.1.1 Unconditional Factor Models

Measures for fund performance including raw returns and risk-adjusted returns derived from alternative factor models will be applied in this study. The unconditional factor models are: Jensen's single factor model, Fama-French's three-factor model, Carhart's four-factor model. We also add a quadratic term in the market excess return to each of the three unconditional

factor models to capture fund manager's market timing ability as suggested by Treynor and Mazuy (1966). The unconditional alpha can be estimated from the following equation:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i\left(R_{m,t} - R_{f,t}\right) + \gamma_i SMB_t + \delta_i HML_t + \lambda_i MOM_t + \eta_i\left(R_{m,t} - R_{f,t}\right)^2 + \varepsilon_{i,t} \qquad (4.1)$$

where $\left(R_{m,t} - R_{f,t}\right)$ is the excess return on the market benchmark index at time t, SMB_t is the return on a size factor, which measures the difference in returns between a portfolio of small companies and on a portfolio of big companies; HML_t is the return on the book-to-market factor, which is computed as returns on a high book-to-market portfolio minus the returns on a low book-to-market portfolio. MOM_t measures one-year momentum effect; α_i, Jensen's alpha, measures the abnormal performance of fund i and $\varepsilon_{i,t}$ is the error term. A significantly positive η_i indicates superior market timing ability of mutual fund managers while a negative and significant η_i indicates inferior market timing ability. When η_i=0 in equation (4.1), Carhart four-factor model is obtained. When λ_i=0, and η_i=0, Fama and French three-factor model is obtained. When γ_i=0, δ_i=0, λ_i=0, and η_i=0, the single factor model is obtained. We also compute the total performance measure (TM) proposed by Grinblatt and Titman (1994) to assess stock picking and market timing ability simultaneously:

$$TM = \alpha_i + \eta_i Var\left(R_{m,t} - R_{f,t}\right)$$

where $Var\left(R_{m,t} - R_{f,t}\right)$ measures the variance of the market excess return. The computation process of standard error for TM was described in Grinblatt and Titman (1994, p. 441).

We don't apply any conditional performance measures in this study since we have no access to dividend yield data for international funds. Although Kosowski et al. (2006) suggested that the results derived from conditional performance measures and unconditional measures are quite similar, we never know if it also applies to UK data just as Gregory, Tharyan and Christidis (2013) reports that the risk factors predicting US mutual fund performance fail to explain the cross-section of returns in the UK. We shall test conditional models in the future studies to make the results more robust.

4.1.1.2 Bootstrap Simulation

When applying these multifactor models to evaluate fund performance, we implicitly assume that the time series returns of individual mutual funds are normally distributed. However, Kosowski et al. (2006) suggested that except for extreme cases including homogeneous risk taking across all funds and normally distributed individual fund alphas, normality cannot be

fulfilled in most fund analysis, as varying levels of time-series correlation in returns for individual stock might exit, which will lead to misleading inference on fund manager skills. It is especially significant among best and worst performers, which matter the most to investors if incorrect statistical inference is drawn. In order to distinguish skilled managers from those that outperform the market purely by luck, it is necessary to apply bootstrap techniques to examine the statistical significance of the alphas while controlling for luck. Kosowski et al. (2006)'s findings have significant implications for the study of the flow-performance relationship and performance persistence. Berk and Green (2004) argued that one couldn't simply conclude that a lack of persistence in fund performance implies that there is no superior manager skill as it could be attributed to large fund inflows combined with decreasing returns to scale. Bootstrap techniques, on the other hand, provide a valid method to uncover fund managers' superior talent. Kosowski et al. (2006) discussed the close association between their work and the Berk and Green (2004) model and suggested that the reversion to mean in performance for top performers was observed to be slower than expected. Fama and French (2010) employed an alternative bootstrap method to capture luck in returns and their findings rejected the Berk and Green (2004)'s prediction on mutual fund returns and suggested that no manager skill exist in their sample. Controversy exists in this research field when different bootstrap methods were applied to the UK data (Blake et al., 2017).

The bootstrap simulation method employed by Kosowski et al. (2006) was developed by Efron and Tibshirani (1994). This approach estimates sampling distribution of alphas and corresponding t-statistics through resampling residuals and then draws comparisons between the sampling distribution and actual distribution to get statistical inference on luck and skill. It is worth noting that the common risk factors are not resampled in this approach. In contrast with Kosowski et al. (2006), Fama and French (2010) run the simulation by jointly resampling the factor returns and the residuals for all funds instead of resampling residuals of each fund only. They argue that this resampling method maintains the cross-correlation of fund returns although it still suffers from the same problem as Kosowski et al. (2006)'s approach: losing autocorrelations in returns as well as time variation in the regression slopes (Fama and French, 2010)[5]. Different bootstrap methods can lead to different inferences.

[5] This problem can be addressed by extending the Fama and French (2010) bootstrap procedure to include blocks of consecutive data. The block bootstrap will not be covered in the thesis. We leave it for future research.

According to Blake et al. (2017), Kosowski et al. (2006)'s bootstrap method implicitly assume that the residuals are independent across different funds and the impact of common risks stay unchanged during the sample period. In contrast, Fama and French (2010) take both systematic and non-systematic risk into account in evaluating manager skills. With differences in bootstrap method, inclusion criterion and simulation times, the two studies yield different results. While Kosowski et al. (2006) find evidence of a small number of skilled managers, Fama and French (2010) draw the conclusion that no manager skills can be found. Thus, Blake et al. (2017) point out that it is important to identify whether the different results stem from the method applied or different dataset, inclusion criterion and simulation times. They compare the two bootstrap methods using the same dataset with the same survival rule and find evidence of small group of skilled managers in terms of gross returns following Kosowski et al. (2006). However, they find little evidence of outperformance when jointly resampling the fund and factor returns as suggested by Fama and French (2010). The different outcomes based on alternative bootstrap methodology employed are attributed to the fact that Fama and French (2010) controlled for both systematic and unsystematic risk while Kosowski et al. (2006) only consider the unsystematic risk.

The residual resampling method employed by Kosowski et al. (2006), firstly run ordinary least squares regression for the monthly excess returns of each fund i to obtain alpha estimates, factor loadings and residuals. Then under the null of zero abnormal performance $(\alpha_i = 0)$, a series of pseudo excess returns are constructed for each fund i by randomly drawing a sample, with replacement, of length T_i from the residuals we saved in the first step while retaining the original ordering of the risk factors:

$$(R_{i,t} - R_{f,t})^b = \hat{\beta}_i \left(R_{m,t} - R_{f,t}\right) + \hat{\gamma}_i SMB_t + \hat{\delta}_i HML_t + \hat{\lambda}_i MOM_t + \hat{\varepsilon}_{i,t}^b$$

where b is the bth bootstrap simulation and $\hat{\varepsilon}_{i,t}^b$ represents a resampled bootstrap residual. Next, for $b = 1$, the pseudo excess returns are regressed on common risk factors and the resulting alpha estimate and corresponding t-statistic are saved for each fund i:

$$(R_{i,t} - R_{f,t})^b = \alpha_i + \beta_i\left(R_{m,t} - R_{f,t}\right) + \gamma_i SMB_t + \delta_i HML_t + \lambda_i MOM_t + \tilde{\varepsilon}_{i,t}$$

The above bootstrap simulation process is repeated 10000 times ($b = 10000$). The resulting alphas represent sampling variation under the null of zero true alpha. The bootstrapped alphas then are ranked from the smallest to the largest for each fund i as well as across all funds to

yield luck distributions of the alphas. Similar cross-sectional distributions of bootstrapped t-statistics will also be produced. The distribution of bootstrapped alphas across all funds can be compared with the actual distribution of alphas to obtain inference on fund manager skill. The inference based on t-statistics can be acquired following the same procedure.

To apply the bootstrap method employed by Fama and French (2010), we jointly resample the factor returns and the residuals for all funds instead of resampling the residuals only for a single fund in Kosowski et al. (2006). Therefore, for each bootstrap iteration b, a common time ordering across all funds is produced. Then, under the null of no abnormal performance, the bootstrapped pseudo excess returns for each fund i are generated by deducting the actual alpha estimate from each resampled month's returns for each fund i and regressed on the factors:

$$[(R_{i,t} - R_{f,t}) - \hat{\alpha}_i]^b = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + \gamma_i SMB_t + \delta_i HML_t + \lambda_i MOM_t + \tilde{\varepsilon}_{i,t}$$

The above bootstrap simulation process is repeated 10000 times ($b = 10000$). We also save all the estimated bootstrapped alphas and corresponding t-statistics and rank them from the lowest to the highest to create luck distributions as described above.

In this thesis, we will apply bootstrap procedure to risk-adjusted performance measures and mainly focus on the resampling methodology applied by Fama and French (2010)[6], which not only addresses the non-normality in returns but also allows comparisons between our results and previous evidence gained by Kosowski et al. (2006), Cuthbertson, Nitzsche and O'Sullivan (2008), Busse, Goyal and Wahal (2013) and Blake et al. (2017). Carhart four-factor model is utilized as the baseline model as it has become a standard fund performance measurement model in existing literature.

4.1.2 Flow-Performance Relationship

4.1.2.1 Basic Regression Model for Flow-Performance Relationship

In order to investigate the relationship between subsequent fund flow and past performance for both UK domestic and international equity unit trusts, we develop a basic regression model, which is specified as follows:

[6] We are very grateful for the assistance of Tristan Caulfield who provided the simulations used in Blake et al. (2017). We rewrite the routines that were written in Python into Matlab.

$$Flow_{i,t} = \gamma_0 + \gamma_1 Past\ Perf_{i,t-n} + \gamma_2 Fund\ Characteristics_{i,t-n} + \gamma_3 Control\ Variables_{i,t-1} + \varepsilon_{i,t} \quad (4.2)$$

where $Flow_{i,t}$ is the net absolute or percentage growth in net asset value of fund i at time t, which is measured over 3 month, $Past\ Perf_{i,t-n}$ can be alternative performance measures calculated over different time horizons, for example, 12 months (short term) and 36 months (long term) with n standing for the number of lags, $Fund\ Characteristics_{i,t-n}$ includes the following variables: $Riskiness_{i,t-n}$ indicates the overall risk level of fund i, measured by rolling standard deviation of monthly net returns over the same period in which the performance is measured, $Expenses_{i,t-1}$ denotes the total fees measured by annual management charge (AMC) plus geometric annual average of initial load that amortized over five years[7] for fund i at time $t-1$, $Fund\ Size_{i,t-1}$ is measured by the logarithm of total net asset of fund i in period $t-1$, $Fund\ Family\ Size_{i,t-1}$ measures the absolute value of total net asset held by the fund family fund i belongs to at $t-1$, $OBJFlows_{i,t}$ measures the growth rate of net new funds flow into an objective category[8] that fund i belongs to at time t, $Fund\ Age_{i,t}$ is calculated as the logarithm of fund age plus one for fund i at time t, other $Control\ Variables_{i,t-1}$ are $FX_{i,t-1}$, which measures the quarterly percentage change in the period average indirectly quoted exchange rates between the UK pounds and the local currency of international fund i currencies at time $t-1$[9], and $Correlation_{i,t-1}$, which measures the correlation of the net monthly return of international fund i with domestic market return over the previous 12 months. These two control variables are only included in the regression analysis for international funds. All the exchange rate data are obtained from Bank of England Statistical Interactive Database[10]. Besides, we use IMA sectors and Lipper schemes as the objective categories and for UK domestic and international mutual funds respectively.

[7] Investors pay loads when they enter and exit a fund, so it is necessary to amortize these loads over the investor's holding period. Since we do not have data on actual holding period by fund, following Khorana, Servaes and Tufano (2008) and Blake et al. (2017), we assume an average of 5 year holding period in the analysis.

[8] We use IMA sectors and Lipper schemes as the objective categories for UK domestic and international mutual funds respectively.

[9] For international funds that invest in a single foreign country, the exchange rate between the UK pound and local currency of that country is used. For international funds primarily investing in Europe, the exchange rate between the UK pound and the European currency unit is used before 1999 and the exchange rate between the UK pound and the euro is used after 1999. For all other international funds, the broad nominal effective exchange rate of the UK pound, which measures the exchange rate between the UK pound with the currencies of the rest world, is used.

[10] Access at: http://www.bankofengland.co.uk/boeapps/iadb/NewInterMed.asp?Travel=NIx

This basic model (4.2) can be adapted to different scenarios and different research questions. For example, in order to analyze the distinct flow-performance relationships in different performance quintiles, piecewise linear regression will be run following Sirri and Tufano (1998)'s procedure. To investigate the determinants of fund flows as well as the impact of participation costs on the sensitivity of flow-performance relationship, we also include a series of independent variables into our regression analysis to control for the effects of fund characteristics on fund flows. Ferreira et al. (2012) suggest that variables including fund risk level, fund size, fund age, fund family size and AMCs are important in predicting future fund flows and explaining the sensitivity of subsequent fund flows to past performance, and thus will be controlled in the regression analysis for both UK domestic and international mutual funds[11]. Recently, Cashman et al. (2014) find that fund flows show significant persistent pattern, which is a dominant predictor of future fund flows. Therefore, we also take past fund flows into consideration and run regressions with past fund flows as a control variable to validate the argument made by Cashman et al. (2014). For UK-based international equity unit trusts, Zhao (2008) discuss the determinants of retail fund flows into international equity mutual funds and suggest that most control variables included in research on flow-performance relationship for domestic funds also have explanatory power over international fund flows. In addition, changes in exchange rates and correlation of international fund return with domestic equity market return are found to have significant impact on subsequent fund flows to international funds. Hence, we additionally control for these two variables in the regression model for UK-based international unit trusts.

4.1.2.2 Definitions of Fund Flows

In accordance with previous studies (e.g. Gruber, 1996; Sirri and Tufano, 1998; Goriaev, Nijman and Werker, 2008; Ferreira et al., 2012), net flow is defined as the net percentage growth in fund assets, which is calculated as:

$$Net\ Percentage\ Flow_{i,t} = \frac{TNA_{i,t} - \left(1 + R_{i,t}\right) * TNA_{i,t-n}}{TNA_{i,t-n}}$$

where $Net\ Percentage\ Flow_{i,t}$ represents the net percentage flow of fund i over n month, $TNA_{i,t}$ indicates the total net asset of fund i at time t, and $R_{i,t}$ is the accumulated return

[11] We might not include all control variables in the regression analysis for every research question. Whether to include a control variable depends on the research method we use.

(gross return plus geometric average of initial load amortized over five years) on fund i from time $t-n$ to t.

We also employ absolute measure for fund flows:

$$Net\ Pound\ Flow_{i,t} = TNA_{i,t} - \left(1 + R_{i,t}\right) * TNA_{i,t-n}$$

where $Net\ Pound\ Flow_{i,t}$ represents the absolute cash flow of fund i over n month, $TNA_{i,t}$ indicates the total net asset of fund i at time t, and $R_{i,t}$ is the accumulated return on fund i from time $t-n$ to t.

4.1.3 Performance Persistence

To empirically test persistence in mutual fund performance, there are primarily three types of methodologies, which are recursive portfolio test, contingency tables and cross-sectional regressions of current alphas on past alphas (Carpenter and Lynch, 1999). All the three methods have been extensively applied in performance persistence literature (e.g. Stephen J Brown and Goetzmann, 1995; Malkiel, 1995; Carhart, 1997). In this thesis, we use recursive portfolio test, also known as performance ranked portfolio test, which was advocated by Carpenter and Lynch (1999) as the most powerful test for performance persistence especially in the presence of survivorship bias to analyze performance persistence in UK domestic and international funds as well as empirically test Berk and Green (2004)'s prediction about the effect of fund flows on performance persistence in UK domestic and international funds.

4.1.3.1 Performance Ranked Portfolio Test

We compute abnormal returns using CAPM, Fama-French three-factor model, Carhart four-factor model and Carhart four-factor model with market timing as the basis for performance rankings. The factor loadings are estimated over the entire sample, which means we assume that they remain constant for the entire sample period. This assumption ignores changes in factor loadings over time and may result in look-ahead bias. Therefore, we also estimate the time-varying factor loadings based on Carhart four-factor model by running rolling regression over past 24 months and calculate associated abnormal returns for each fund. While much of the literature uses a 36-month rolling window (e.g. Berk and Tonks, 2007), we choose to run regression over the past 24 months due to the shorter period our sample covers.

At the end of each ranking period, we rank UK domestic and international equity mutual funds respectively on the basis of their abnormal returns from whole sample regression using the four factor models aforementioned over the ranking period, and then divide them into five equally weighted portfolios. In the subsequent evaluation period, we calculate the monthly equally weighted portfolio return of the top and the bottom quintile portfolios as well as the difference in monthly average returns between the top and the bottom quintile portfolios (spread-position portfolios). Instead of reporting the average abnormal return with t-statistics, we further measure the performance of the top and the bottom quintile portfolios as well as the spread-position portfolios using alternative performance measurement models and report alphas computed from Carhart four-factor Model[12] following Berk and Tonks (2007) with "stars" to indicate different levels of significance[13]. To provide evidence on both short-term and long-term performance persistence, we test five symmetrical ranking and evaluation periods including one month, three months, six months, 12 months and 36 months.

4.1.3.2 Empirical Test of the Equilibrating Mechanism of Fund Flows in Berk and Green (2004)

To test the equilibrating mechanism of fund flows in Berk and Green (2004) model of fund flows, we apply the double sorting method employed by Bessler et al. (2010). Funds are ranked into quintiles based on their past abnormal returns first, and further sorted into subgroups based on whether they receive higher or lower than median fund flows of all other funds in the same quintile in the formation period. Then the performance of each portfolio will be measured as standard recursive portfolio approach does to test whether there exists performance persistence in mutual funds that receive different levels of net fund inflows.

4.2 Data

4.2.1 Returns Data

Our sample includes two types of funds available in UK fund market for retail investors: domestic equity unit trusts and international equity unit trusts. Monthly returns on 668 domestic funds and 657 international funds from January 1998 to March 2015 as well as

[12] We choose to report the risk-adjusted performance based on Carhart four-factor model, as Carhart four-factor model is a stringent and also the base model employed in most literature. The results obtained using the other three factor models are in general consistent to the results we report using Carhart four-factor model.

[13] Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively。

information on investment objective, fund size, initial charge, exit charge, AMCs, and parent company of each fund are provided from a combination of Lipper Hindsight, Morningstar and Defaqto databases, which are world leading suppliers of mutual fund information. According to IMA definitions, the primary sector classes for UK domestic equity mutual funds included in this study are UK All Companies, UK Equity Income, and UK Smaller Companies. As for international funds, Lipper classifies them into different schemes according to their investment objectives, which specify both geographical orientation and primary investment aims, for instance, Equity Asia Pacific ex Japan, Equity Global, Equity Global Income, Equity Emerging Markets Asia and etc. For each fund, the monthly returns are calculated as percentage change in bid-to-bid prices adjusted for reinvested dividends and capital gains. Net monthly returns are net of on-going operating expenses, trading costs and AMCs. On-going operating expenses include administration fees, distribution charges known as 12-1 fees and other operating and trading costs involved in fund daily operation such as record-keeping, research, custody, accounting, auditing, valuation etc., while trading costs include commissions, spreads and taxes (Khorana, Servaes and Tufano, 2008). Since we only have access to net monthly returns, monthly equivalent of annual management charge and geometric monthly value of initial charge amortized over 5 years are added to monthly net returns to derive proxies for raw monthly returns, which are used for calculating fund flows. We also compute gross monthly returns net of operating and trading costs as well as any initial or exit loads involved but before deducting management fees. Since we are interested in studying the behaviour of individual investors, throughout the thesis, the main focus is on net returns to investors after all the expenses have been deducted.

Our sample is a new sample with comprehensive UK fund returns data. Compared to other recent research on UK fund industry (e.g. Ferreira et al., 2012), our sample includes recent data for both UK domestic and international unit trusts, for a period of 17 years, from 1998-2015. It not only allows us to obtain up to date evidence on mutual fund performance, flow-performance relationship and performance persistence from both UK domestic and international unit trusts respectively but also makes it possible to draw a comparison between these two different collective investment vehicles. In addition, the sample period includes business cycle expansions and contractions and especially two major shocks: 2000 dot.com bust and 2008 financial crisis.

4.2.2 Dataset Construction

To construct the dataset for UK domestic unit trusts/OEICs, we extend the dataset utilized by Blake et al. (2014) by including newly constructed UK domestic unit trusts/OEICs identified from Trustnet.com[14] after 2008, which are available to retail investors and expanding the sample to cover the period from January 1998 to March 2015. For funds with more than one share classes, unlike most US studies that use a value weighted average of returns across all share classes, we are unable to acquire fund size data at share class level and only have data for the primary share class for each fund. Since one of the main research aims is to examine active management, index funds and tracker funds are excluded from the sample. In line with exiting literature, we focus on equity funds only, and exclude balanced funds, mixed-asset funds, fund of funds and sector funds. Exchange-traded funds (ETFs) are also excluded from the sample as ETFs are established very like close-end funds except that it can be traded at the net asset value at the end of each trading day (Elton and Gruber, 2013). Besides, most ETFs track an index and passively managed, which is not the focus of our study. Sherrill, Shirley and Stark (2017) examined the performance of actively managed mutual funds that hold large positions in passive ETFs and concluded that after controlling for fund styles and characteristics, these funds show no evidence of inferior stock picking and market timing skill when alternative performance measures are employed. They pointed out that around 38% of actively managed mutual funds held ETFs in their portfolio over the sample period from 2004 to 2015. Unfortunately, we do not have information on the actual portfolio holdings of the active equity mutual funds in our sample. However, it is worth in-depth investigation as taking large ETF position might be an explanation for the underperformance of active mutual funds. The initial dataset employed by Blake et al. (2014) contained 561 UK domestic open-end equity unit trusts/OEICs, covering a period from January 1998 to December 2008. This initial dataset is free of survivorship bias by construction as it includes both live and dead funds during the sample period. We identify a total of 193 UK domestic unit trusts/OEICs that were not in existence at December 2008 and thus were not included in the initial dataset from Trustnet.com. We cross check by fund names, sedol numbers and ISIN codes the 193 new funds with the 561 funds from Blake et al. (2014) to ensure that there are no duplicates. However, we only obtain return data and fund information on 107 out of the 193 unit

[14] Access at: https://www.trustnet.com/

trusts/OEICs that we have identified from Lipper Hindsight and construct our final sample containing a total of 668 UK domestic open-end equity unit trusts/OEICs. We require data on the 668 UK domestic unit trusts/OEICs for the whole period from January 1998 to March 2015 from Lipper Hindsight to allow for cross checking the net returns for each of the 561 funds from Blake et al. (2014)'s data against the net returns from our 668 dataset over the overlapping time period that is prior to January 2009. We can confirm that the 561 sample and the 668 sample of monthly net returns match exactly with each other. In our final UK domestic unit trusts/OEICs sample, there are 383 active funds and 285 dead funds that cease to operate due to liquidation and merger.

For UK-based international equity mutual funds, as a starting point, we identify 419 UK-based international open-end equity mutual funds from a comprehensive survivorship bias free database containing around 3200 UK domestic and international open-end equity mutual funds[15] over 1998-2008 by applying a filter that excludes any index funds, tracker funds, balanced funds, mixed-asset funds, fund of funds and sector funds. These UK-based international funds are not restricted to invest in developed regions or diversify their portfolios globally only. We also include emerging market funds that either concentrate on a single developing country or a broad emerging market. Following the same methodology that applies to construct UK domestic unit trusts sample, we extend the initial international fund dataset by identifying newly constructed UK-based international equity mutual funds that are not listed in the 3200 database from Trustnet.com. We find another 454 live international equity mutual funds available to UK retail investors in the market by cross checking the fund name, sedol numbers and ISIN codes. Based on the information on fund investment scheme for the 873 international equity mutual funds provided by Lipper Hindsight, we drop tracker funds, balanced funds, mixed-asset funds, fund of funds and sector funds as well as those funds that are not classified into any Lipper schemes or have no record of performance history. Eventually, we arrive at a final sample consisting of 657 international equity mutual funds with monthly data over the period from January 1998 to March 2015. We also cross check the net returns for each of the 419 funds from the 3200 database against the net returns from our final 657 dataset over the overlapping time period that is prior to January 2009 to ensure that the monthly net return series from different resources do not deviate significantly.

[15] We thank Professor Ian Tonks for providing this "3200database" and fund list. This was also the original dataset from which the 561 UK domestic open-end equity unit trusts/OEICs used in Blake et al. (2014) was identified.

In our final international equity mutual funds sample, there are 524 active funds and 133 dead funds that cease to operate due to liquidation and merger.

4.2.3 Survivorship Bias

Survivorship bias occurs when the dataset fails to include information on closed funds or drops poor performance histories of surviving funds. It has been widely studied since 1990s either as a main subject or additional tests for robustness (e.g. Stephen J Brown and Goetzmann, 1995; Malkiel, 1995; Elton, Gruber and Blake, 1996; Carhart, 1997; Carhart et al., 2002). According to Elton, Gruber and Blake (1996), this bias was neglected by most early studies on fund performance, leading to inaccurate results. As most funds are excluded from the dataset because of inferior performance, the average performance of mutual funds from can be overestimated and the results for other performance related research questions could be biased. Elton, Gruber and Blake (1996) point out that the returns reported for mutual fund with different investment objectives are easily biased as different rates of attrition respond to different objectives. Survivorship bias can be measured by subtracting the average alpha for all funds from the average alpha for surviving funds. Through comparing the results derived from a sample with survivorship bias and another one without survivorship bias, impact of survivorship bias on performance can be measured. By applying this approach, Elton, Gruber and Blake (1996) report that survivorship bias can result in 0.9% per annum difference in risk-adjusted returns between the full sample and the surviving sample in US mutual fund industry in addition to the argument that the survivorship exhibited in almost all prior studies. Similar findings are documented by Grinblatt and Titman (1992), Malkiel (1995) and Stephen J Brown and Goetzmann (1997). This issue is addressed in the majority of recent studies on mutual funds especially on fund performance and persistence. Data providers also pay great attention to the survivorship bias and attempt to overcome this problem by comprehensively including full performance histories of both surviving and dead funds during the sample period.

A milestone in the US mutual fund research is the construction of the CRSP Survivor-Bias-Free US Mutual Fund Database. The original database was developed by Mark M. Carhart in 1995 for his doctoral thesis. It has been further developed and maintained by the Centre for Research in Security Prices by collecting current and historical data on both surviving and non-surviving funds from a variety of sources. Although Elton, Gruber and Blake (2001)

point out the omission bias and missing value issues in CRSP database, it provides researchers undertaking studies on the US mutual fund industry with a dataset uncontaminated by survivorship issues. In the UK, such a survivorship bias free database for UK open-end equity unit trusts/OEICs is not publicly available. Although data providers such as Lipper and Morningstar keep record of return history for a wide range of mutual funds, these commercial databases generally suffer from survivorship bias as they mainly focus on providing information on potential investments that are currently available in the market to their clients and tend to remove the records of those funds that have been merged or liquidated. Malkiel (1995) addresses the problem of survivorship bias and suggest that spurious performance persistence might be found for high-risk funds that earn high returns from taking a successful bet, as the records for those unsuccessful funds will be removed. Since it is difficult to market mutual funds with poor performance records, the worst performing funds are normally merged into successful funds to maintain a good record for the fund family to which these funds belong. Severe survivorship bias can also result from the incubation practices employed by fund complexes (Evans, 2007). A fund complex may start a number of new funds managed by different in-house managers with the intention to harvest the most successful ones and drop the worst performing funds to maintain a strong past performance record. Those successful funds will be aggressively marketed while the record of those unsuccessful funds will be buried. The non-surviving funds that fail to be included in databases are often the poorly performing funds. However, even if a fund is not the worst performer, it also might be merged into a more successful fund to create a "star" fund for the fund family for marketing purposes. However, the ex-post performance of mutual fund merger is determined by the similarity in management objectives and investment strategies between funds. Namvar and Phillips (2013) examined the performance of post-merger mutual funds and suggested that mergers between funds with similar investment objectives and strategies achieve superior performance than mergers between funds with different objectives even these funds hold more assets in common. It seems that mergers can collaborative benefits for mutual funds and the funds that find themselves merged by other funds are not always poorly performing funds.

The sample utilized in this thesis is free from survivorship bias over the period from January 1998 to December 2008 as both surviving funds and dead funds are included. However, for the sample period from 2009 to 2014, the dataset might suffer from survivorship bias as the

newly included funds that we have identified from Trustnet.com since 2014 are funds that have survived the previous 5 years. We have no record for short-lived funds that were constructed and also terminated in the five years from 2009 to 2013. However, since we restrict a minimum of 20 months of return data for funds to be included in analysis, those funds with very short life will be removed from our final sample. Therefore, we expect that the potential survivorship bias will not significantly distort our results. For funds that have been merged, we have no information on which funds they were merged with. It prohibits us from further investigating the potential benefits of mergers.

4.2.4 Investment Objectives and Classifications

UK domestic unit trusts/OEICs are classified into different investment sectors in terms of their investment objectives. Three investment sectors identified by Investment Management Association are included in this thesis, which are UK All Companies, UK Equity Income and UK Smaller Companies. We acquire the information on investment sectors from Lipper, which only record the current fund sector for each unit trust. Therefore, it is impossible for us to identify funds that have changed their investment objectives without historical data on fund investment objectives. Since we focus on equity mutual funds only in this thesis, a potential problem with changing investment sector is that part of the return time series might be generated under some other objectives rather than an equity objective. Besides, changing investment sector will only impact the analysis conducted at the sector level and will not bias the results obtained at the entire sample level. We cross check the fund sector data for each of the funds that are included in our final sample from the 3200 database against the fund objective data from the extended sample purchased from Lipper and find no evidence that funds change their investment sectors over time in our sample.

International equity mutual funds are categorized into different Lipper schemes in terms of their investment objectives and geographical focus when IMA sectors are not available. The 29 Lipper schemes are listed in Table 4.1. Equity Global funds account for around 45% of the total number of international funds while 102 out of 657 funds are classified as Equity Asia Pacific ex Japan funds. We also include 177 emerging market funds with investment focus on either a single developing country or a number of emerging markets. The Lipper schemes are too detailed to apply in our analysis of fund performance, flow-performance relationship and

performance persistence. We develop our own classifications to gather all international funds with the same broad geographical focus together as well as distinguish their investment styles.

The six new fund schemes[16] are Asia Pacific (116 funds), Europe (4 funds), Global (357 funds), Japan (1 funds), US (2 funds) and Emerging Markets (177). International funds with investment objective defined by Lipper as "**Equity Asia Pacific**", "**Equity Asia Pacific Sm&Mid Cap**", "**Equity Asia Pacific ex Japan**", "**Equity Australia**", and "**Equity Hong Kong**" are categorized as "Asia Pacific" funds. Funds with investment objective defined by Lipper as "**Equity Europe**" are assigned with a new fund scheme name "Europe". International funds with investment objective defined by Lipper as "**Equity Global**", "**Equity Global Income**", "**Equity Global Sm&Mid Cap**", "**Equity Global ex UK**", and "**Equity Global ex US**" are classified into fund scheme "Global". Funds with investment objective defined by Lipper as "**Equity US**" and "**Equity US Sm&Mid Cap**" are assigned to fund scheme "US". The remaining 117 funds with investment objective defined by Lipper as emerging market funds are classified into fund scheme "Emerging Markets". Table 3.1 provides a detailed summary of fund classifications that fulfil different research purposes. To allow for comparisons between domestic and international funds at sector level, we classify international funds into three groups based on their investment styles. They are Equity Growth (607), Equity Income (36) and Small&Mid Companies (14), which are comparable to UK All Companies, UK Equity Income and UK Smaller Companies respectively. In order to study the difference in performance and performance persistence between funds that diversify globally and funds that mainly invest in specific regions, we include Equity Global funds, Equity Global Income funds, Equity Global Sm&Mid Cap funds, Equity Global ex UK funds and Equity Global ex US funds in the "Globally Diversified" subsample and leave the remaining funds to be included in the "Regionally Focused" subsample. We also draw a subsample containing developed market funds only for robustness checks as the risk factors we employ are constructed for developed countries. It is worth noting that the "Regionally Focused" subsample contains both developed market funds with investment focus on specific regions and countries and emerging market funds that primarily invest in developing countries and areas.

[16] Fund schemes for UK-based international equity mutual funds throughout the thesis refer to the classifications developed by our own rather than the Lipper Global Schemes if not otherwise specified.

Table 4. 1: Summary of International Equity Mutual Fund Classifications for Different Research

Lipper Schemes	No. of Funds	Fund Schemes	Investment Objectives or Styles	Globally Diversified (1) /Regionally Focused (2)	Developed Markets (3) /Emerging Markets (4)	Fama and French Risk Factors
Equity Asia Pacific	11	Asia Pacific	Equity Growth	(2)	(3)	Asia Pacific ex Japan
Equity Asia Pacific Sm&Mid Cap	1	Asia Pacific	Small&Mid Companies	(2)	(3)	Asia Pacific ex Japan
Equity Asia Pacific ex Japan	102	Asia Pacific	Equity Growth	(2)	(3)	Asia Pacific ex Japan
Equity Australia	1	Asia Pacific	Equity Growth	(2)	(3)	Asia Pacific ex Japan
Equity Brazil	4	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity China	10	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Emerging Mkts Global Small&Mid-Cap	3	Emerging Markets	Small&Mid Companies	(2)	(4)	Global ex US
Equity Emerging Mkts Asia	1	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Emerging Mkts Europe	11	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Emerging Mkts Global	84	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Emerging Mkts Latin Am	15	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Emerging Mkts Other	3	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Europe	4	Europe	Equity Growth	(2)	(3)	Europe
Equity Frontier Markets	2	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Global	295	Global	Equity Growth	(1)	(3)	Global
Equity Global Income	36	Global	Global Income	(1)	(3)	Global
Equity Global Sm&Mid Cap	9	Global	Small&Mid Companies	(1)	(3)	Global
Equity Global ex UK	15	Global	Equity Growth	(1)	(3)	Global
Equity Global ex US	2	Global	Equity Growth	(1)	(3)	Global ex US
Equity Greater China	18	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Hong Kong	1	Asia Pacific	Equity Growth	(2)	(3)	Asia Pacific ex Japan
Equity India	14	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Japan	1	Japan	Equity Growth	(2)	(3)	Japan
Equity Korea	3	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity MENA	3	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Russia	5	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity Turkey	1	Emerging Markets	Equity Growth	(2)	(4)	Global ex US
Equity US	1	US	Equity Growth	(2)	(3)	North America
Equity US Sm&Mid Cap	1	US	Small&Mid Companies	(2)	(3)	North America
Total	657	6	3	2	2	6

4.2.5 Fee Charges and Fund Size

Since Lipper has no record on the history of total expense ratio, annual management charge, initial and back-end loads, we only have access to information on AMC and initial load for all surviving funds at December 2014 if they are alive at this point of time and for all dead funds at the date they cease to operate after 2008. Over the period from January 1998 to December 2008, complete information on AMCs and initial loads is only available for 451 UK domestic equity unit trusts and 223 international equity unit trusts. We observe that the AMC and initial load for most UK equity mutual funds in the 3200 database are fairly stable during 1998-2008. Therefore, for each fund with a fee charge observation after 2008, if the observation is identical to the fee charge at December 2008, we assume that the fee charge for those funds stay constant over the sample period from January 2009 to March 2015 and fill in the missing values with the fee charge at December 2008. If the fee charge observations after 2008 are different from the fee charges at December 2008, we assume the only change in fee charges takes place at January 2009 and fee charges stay constant afterwards. For those funds without information on AMCs, we fill in the missing values with the median monthly management fees of all the other funds with AMC data in the same IMA sector (for UK domestic unit trusts) or fund scheme (for international equity unit trusts) and the same size quintile, following the methods applied by Blake et al. (2014). For those funds without information on initial loads, we check with Morningstar first to identify whether a frond-end load applies. Then, we fill in the missing values for those load funds with the median monthly initial load of all the other funds with initial load data in the same IMA sector (for UK domestic unit trusts) or fund scheme (for international equity unit trusts) and the same size quintile. Although we might fail to capture some possible changes in individual fund fees during the 2008 financial crisis by imposing the assumption of stable fee charges, the FCA asset market study published in 2016 confirms that the AMCs for actively managed funds have generally stayed the same since 2005 and most fund managers have no intention of lowering fees charged to attract more retail investors. The price for active equity funds is found to be clustered at 0.75% and 1%, which does not fall as fund size increases. It indicates that individual investors are unable to benefit from any economies of scale and suggests these are captured by the fund managers via management fees.

Incomplete fund size data also causes some concern since net asset values are vital for calculating fund flows and studying flow-performance relationship. The fund size data we acquire from Lipper is on a monthly basis from January 1998 to March 2015. The missing values exist because some mutual fund companies either do not provide this information to Lipper or simply fail to update information on fund size at some points of time. We deal with these missing values in two ways: 1) infilling with the average value of net asset values in the previous period and next period for one missing point between two non-missing values, and 2) assuming no net fund inflows during that period for successive missing points. In addition, some data errors are detected, which we suspect are typos. For instance, the net asset value can jump from £ 10 million to £ 102 million in one month and then drop to 12.3 million in the next month while no mergers or liquidations are reported. Having identified these large values, we corrected these typos manually. The way we process fund size data should not significantly bias the analysis on flow-performance relationship and performance persistence for two reasons. Firstly, we find no evidence of systematic missing data in shorted-lived funds. For UK domestic unit trusts, among the 31 funds with no fund size data, only five of them are merged while for international funds, only four out of 45 funds that have no fund size data terminate because of merger and liquidation. Secondly, when we impose a minimum of 12 monthly net asset values, 58 out of 668 domestic unit trusts/OEICs and 66 out of 657 international equity funds are dropped[17]. More than half of the funds with less than 12 net asset value observations are recently founded and introduced to the market after 2007. Therefore, we believe the missing fund size data will not cause severe distortions of our research results.

4.2.6 Offshore Funds

Among the 657 international open-end equity mutual funds, 96 funds are domiciled in Luxembourg and categorized as offshore funds. The legal structure for these offshore funds is SICAV, standing for société d'investissement à capital variable, which is similar to OEIC and ICVC in UK[18]. Fund managers typically choose to domicile in a different jurisdiction from

[17] The dropped funds include those funds with no fund size data.

[18] A detailed comparison table for fund structures of OEIC and SICAV is presented in Appendix Table 4.12. Throughout the thesis, both onshore and offshore international funds are called UK-based international equity unit trusts/mutual funds. We do not further distinguish offshore funds from onshore funds in empirical analysis as the small numbers of offshore funds do not distort our results.

the location of the fund's daily operations, to benefit from tax exemptions and less stringent regulations. The regulations on financial information sharing and restrictions on capital structure, performance-based fees etc. are much fewer in those countries that compete on fund domicile such as Ireland and Luxembourg (Kim and Wei, 2002).

The main difference between SICAV and OEICs is the fund level taxation as SICAVs subject to the regime of the country where they are registered. Equity funds domiciled in Luxembourg are exempt from corporate tax, net wealth tax and withholding tax when distributing dividends to non-resident clients while the 20% corporate tax is normally unavoidable for OEICs in UK. Individual UK investors are generally not taxed differently from holding shares in SICAVs with Reporting Fund Status[19] with respect to income and capital gains tax. However, capital gains for individual UK investors who invest in SICAV without Reporting Fund Status are classified as offshore income gains and are taxed as income without benefiting from the annual capital gain tax exemption as onshore funds[20]. Since Lipper does not report details of reporting status and tax status for SICAVs, we assume that the tax advantages of offshore funds against onshore funds are limited for UK retail investors in practice.

The average monthly net excess return for SICAVs is 0.80%, which is slightly higher the mean monthly net excess return for onshore unit trust/OEICs. Amongst the 96 SICAVs, 60 funds are emerging market funds, which are characterized by high mean excess returns and high volatility. The impact of SICAVs on our analysis is limited as the number of SICAVs is less than one fifth of the number of onshore unit trust/OEICs and there is no extreme positive or negative net returns detected for offshore funds. In addition, more than half of the offshores are excluded from the developed market funds sample, which is examined individually for robustness.

[19] SICAVs with Reporting Fund Status are obliged to provide detailed information on their income to their UK resident investors and HMRC whether the income has been distributed or not. Then, the tax return for UK investors must include all distributed income as well as any reported but undistributed income unless the investors claim it is foreign source and leave it overseas. SICAVs without Reporting Fund Status are not obliged to provide such report and therefore only the actually distributed income will be taxed for UK resident investors. However, any gain from a non-reporting SICAVs is subject to income tax ranging from 20% to 45% while gains from a reporting SICAVs are subject to capital gains tax ranging from 10% to 20%.

[20] Individual UK investors can completely avoid capital gains tax from investing an onshore fund if the fund is held as part of PEP/ISA, starting from mid-1990s.

4.2.7 Risk Factors and Exchange Rates

In order to measure mutual fund performance, we need data on relevant risk factors, which will be employed in the performance measurement models during the sample period. The size, value and momentum factors for UK domestic equity mutual funds are downloaded directly from Exeter Xfi website[21]. These are constructed following the factor forming methods proposed by Gregory, Tharyan and Christidis (2013) who investigate the validity of Fama-French and Carhart's model in UK fund market. The risk factors for measuring performance of international equity mutual funds are obtained from Kenneth French's web page[22]. As all returns are in US dollar, following Gregory and Whittaker (2007), Chua, Lai and Wu (2008) and Cortez, Silva and Areal (2012), we translate these factors into pound sterling using the month average dollar to pound exchange rate acquired from Bank of England Statistical Interactive Database website.[23] However, these international risk factors are constructed for developed countries[24]. For the 177 international equity mutual funds, which mainly invest in emerging markets and areas in our sample, we use Global ex US factors as proxies for emerging market factors. This implies that global markets are fully integrated. Lehkonen (2014) studies stock market integration over 2008 financial crisis and finds that emerging markets were increasingly integrated while the integration of developed markets reduced during the 2008 financial crisis. The remaining 480 international equity mutual funds, which mainly invest in developed countries, are further classified into six geographical groups identified by Fama and French (2012). They are "Asia Pacific ex Japan", "Japan", "Europe", "North America", "Global", and "Global ex US". We use local factors to capture cross section variation of fund returns as suggested in Fama and French (2012). The details of classification are presented in Table 4.1. Although it is interesting to study the flow-performance relationship for each region, the dataset has limited observations for Europe, Japan and North America. So, we mainly focus on funds with their investment focus on developed countries or emerging markets as a whole.

[21] Available at: http://business-school.exeter.ac.uk/research/centres/xfi/famafrench/files/

[22] Available at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[23] Access at: http://www.bankofengland.co.uk/boeapps/iadb/

[24] Fama and French (2012) employ the MSCI definitions of fund investment objectives and styles. We double check the schemes defined by Lipper with the classification of MSCI index and find they are almost identical in the definition of region focus and selection of countries included in each region index.

The most recent studies of international mutual fund performance advocate the construction of risk factors based on a geographical region focus and in local currency, to avoid introducing biases due to exchange rate changes (Ferreira et al., 2012; Busse, Goyal and Wahal, 2013). When we measure the performance of either equal-weighted or value-weighted portfolio of all international funds, it seems that the explanatory power of Fama-French global risk factors remains strong as developed countries that accounts for two thirds of the total number of international funds and have larger market size should have greater influence on the aggregate fund performance than emerging markets. However, for individual mutual funds with an emerging market objective, the explanatory power of Fama-French Global ex US factors is potentially weaker. However, nearly half of international funds with emerging markets focus in our sample allocate around 20% to 30% of their money to developed countries. Hence, under the assumption of global market integration, Fama-French Global ex US factors should have some explanatory power on cross sectional variation of returns on emerging market funds. Since most of our analysis is conducted on aggregate or average level rather than individual fund level, the impact of these emerging market funds is limited when our sample is heavily skewed to developed countries. To ensure our results are robust, we also draw a sample consisting of all developed market funds and repeat all the tests using this subsample to allow for comparison with the results obtained from employing the entire sample.

4.3 Descriptive Statistics

Table 4.2 presents information on the number of UK domestic and international equity mutual funds respectively over the sample period from January 1998 to March 2015. We count the total number of live funds in relevant samples constructed in terms of fund types, investment objectives and equity sectors in the December of each even year. Changes in the number of funds over time can result from newly established funds that enter the market and dead funds that cease to operate and get liquidated or merged. The number of UK domestic unit trusts rapidly increases from 307 to 441 from1998 to 2004. It fluctuates around 438 in the next six years and peaks at 444 in 2008. From 2008 onwards, the number of UK domestic unit trusts shows a downward trend and decrease to 383 in 2014. One possible reason for the decline in the total number of domestic funds might be 2008 financial crisis, which cause many funds cease to exist and reduced the growth rate of the whole fund industry. Another reason might

be that we fail to include those short-lived domestic funds that were in existence from 2008 to 2014. More than half of the total number of domestic funds are UK All Companies funds. The number of UK All Companies funds grows from 182 to 292 in the first 10 years and slowly reduces to 234 at the end of 2014. UK Equity Income sector, the second largest sector, shows a similar growth trend. UK Smaller Companies sector has the smallest number of funds: the number increases slightly from 1998 to 2004 and fluctuates downward from 2004 onwards. The number of international funds in contrast shows an upward trend from 1998 to 2014. From 1998 on, the total number of international funds increases monotonically from 190, which is slightly more than half of the number of domestic funds, to 547, which is more than three times of the beginning number of international funds at 1998. Around 2008, the number of international funds starts to exceed the number of domestic funds included in our sample.

Table 4. 2: The Number of Funds in UK Domestic and International Equity Mutual Funds Samples

	Sample	1998	2000	2002	2004	2006	2008	2010	2012	2014	1998.1-2015.3
Domestic	Entire Sample	307	356	441	432	436	444	436	414	383	668
	UK All Companies	182	215	258	276	281	292	276	258	234	437
	UK Equity Income	71	80	86	95	101	100	103	102	98	155
	UK Smaller Companies	54	61	67	61	54	58	57	54	51	96
International	Entire Sample	190	234	272	310	397	478	504	520	549	657
	Developed Markets	151	189	219	248	309	358	364	367	384	480
	Emerging Markets	39	45	53	62	88	120	140	153	165	177
	Globally Diversified	101	130	156	180	226	278	302	330	356	357
	Regionally Focused	89	104	116	130	171	200	202	190	193	300

The number of UK domestic and international equity mutual funds is counted in December each even year over the entire sample period. The total number of UK domestic and international equity mutual funds is also reported in the last column.

When the number of domestic funds shows a downward tread from 2008, international funds keep expanding at a relatively higher speed. At the end of 2014, the number of international funds exceeds the number of domestic funds. Developed market funds grow rapidly in the first 10 years from 1998 to 2008. The growth rate slows down from 2008. Emerging market funds show a similar trend as developed market funds. The number of emerging market funds is tripled in 10 years from the end of 1998 to the end of 2008. The total number of emerging market funds is slightly less than half of the number of developed market funds, which indicates that great profit potential of emerging markets has not been fully excavated and mainstream international fund investors still pay more attention to diversify their investment portfolios in developed countries. Unlike the relatively stable relative proportion of each domestic equity sector, the relative proportions of developed market funds and emerging market funds change over the 17-year sample period. The relative proportion of emerging market funds grows from 20% to 30 % over the whole sample period. It seems that 2008 financial crisis does not prohibit investors from investing globally. On the contrary, it prompts investors to diversify investments internationally and benefit from the strong economic growth potential in emerging markets. This trend is also confirmed by a comparison between the growth rate of globally diversified funds and that of regionally focused funds. The number of globally diversified funds increases at a relatively steady rate over the entire sample period except for the period from 2004 to 2008. There is a substantial rise in the number of globally diversified funds before 2008 financial crisis, which might imply an improved individual investor's confidence in the expansion period from 2004 to 2008 as well as an increasing demand of global diversification among international fund investors. In contrast, regionally focused funds grow at a much slower speed compared to globally diversified funds. After 2008, the growth rate of regionally focused funds slows down and the number of funds drops to 190 in 2012, though it slightly recovers in 2014. Although some retail investors attempt to benefit from economic growth in a single market or region especially emerging market funds, it seems that some of the international funds with a single developed market or region objective do not survive 2008 financial crisis and retail investors become more conservative when they attempt to make investment overseas especially in developed countries and areas.

Table 4.3 summarizes the monthly excess returns for UK domestic unit trusts and international unit trusts over the sample period from January 1998 to March 2015 using the monthly return on one-month UK Treasury Bill as the risk-free rate of return. The average net

monthly excess return for UK domestic unit trusts is 0.36% compared to 0.52% for international equity mutual funds. The performance volatility, which is measured by the standard deviation of monthly net excess returns[25], is 4.64% for UK domestic unit trusts while the performance volatility for UK-based international unit trusts is slightly higher with a value of 5.58%. The range in the distribution of excess returns also indicates a higher variation in the returns distribution for international funds in comparison to domestic funds. Therefore, a higher mean net excess return generated by international funds does not necessarily imply superior managerial skill possessed by international fund managers as it may result from international portfolios bearing more risk. The average gross monthly excess return for UK domestic unit trusts is 0.48%, which implies that the monthly fund management fee is around 0.11%. Compared with international funds, this implied monthly fund management fee does not seem to be relatively lower as suggested by other studies on mutual fund fees and charges. In a 2015 fee study conducted by Morningstar, it suggests that although investors' preference over low-cost funds drives expense ratios of US mutual funds down, mutual funds with international equity objective on average levy higher fees in comparison to mutual funds that primarily invest in domestic equities (Rawson and Johnson, 2015). While expense ratio normally includes all operating costs levied, not just limited to AMCs, very few studies provides information on AMCs charged by UK-based international unit trusts and UK domestic unit trusts, which allows us to make a direct comparison. However, intuitively, international funds generally require more manager expertise, more expensive research, and may incur higher transaction cost. Hence, we can expect higher AMCs charged by international funds. In our sample, the information on fund fees and charges is limited especially for international equity mutual funds. Therefore, we mainly use net returns in our analysis of fund performance and performance persistence. Khorana, Servaes and Tufano (2008) define the total shareholder cost as the expense ratio plus initial and back-end loads annualized over 5-year holding period. We apply a similar definition and derive the returns utilized to compute fund flows by adding monthly equivalent of annualized initial load assuming an average holding period of 5 years to the gross monthly return for each fund.

[25] In the case of converting monthly to annual standard deviation, we multiply the monthly standard deviation by $\sqrt{12}$. For example, the annual volatility for UK domestic unit trusts is 16%, which equals 4.64% times $\sqrt{12}$.

Table 4. 3: Descriptive Statistics for UK Domestic and International Equity Unit Trusts 1998.1-2015.3

	UK Domestic Equity Unit Trusts						International Equity Unit Trusts					
	Entire Sample Net Return	Entire Sample Gross Return	Entire Sample Gross Return+Initial Load	≥ 20 Net Return	≥ 20 Gross Return	≥ 20 Gross Return+Initial Load	Entire Sample Net Return	Entire Sample Gross Return	Entire Sample Gross Return+Initial Load	≥ 20 Net Return	≥ 20 Gross Return	≥ 20 Gross Return+Initial Load
Mean	0.36%	0.48%	0.55%	0.37%	0.48%	0.55%	0.52%	0.63%	0.71%	0.52%	0.63%	0.71%
Std. Dev.	4.64%	4.64%	4.64%	4.64%	4.64%	4.64%	5.58%	5.58%	5.58%	5.59%	5.59%	5.59%
Distribution of Returns												
10%	-5.43%	-5.32%	-5.25%	-5.43%	-5.32%	-5.24%	-6.24%	-6.13%	-6.05%	-6.25%	-6.14%	-6.06%
25%	-1.85%	-1.74%	-1.66%	-1.85%	-1.74%	-1.66%	-2.36%	-2.24%	-2.16%	-2.37%	-2.25%	-2.17%
50%	0.90%	1.01%	1.08%	0.90%	1.01%	1.09%	0.90%	1.01%	1.09%	0.90%	1.01%	1.09%
75%	3.03%	3.14%	3.21%	3.03%	3.14%	3.22%	3.72%	3.83%	3.90%	3.72%	3.83%	3.91%
90%	5.39%	5.50%	5.57%	5.39%	5.50%	5.58%	6.68%	6.79%	6.87%	6.69%	6.81%	6.88%
Observations	84,006	84,006	84,006	83,782	83,782	83,782	77,963	77,963	77,963	77,590	77,590	77,590
No. of Funds	668	668	668	650	650	650	657	657	657	627	627	627

Table 4.3 summarizes the monthly excess returns for UK domestic and international equity mutual funds over the entire sample period from January 1998 to March 2015 using the monthly return on one-month UK Treasury Bill as risk free rate of return. Net monthly returns are calculated as percentage change in bid-to-bid prices adjusted for reinvested dividends and capital gains and net of on-going operating expenses, trading costs and AMCs. Gross monthly returns are computed as net monthly returns plus monthly equivalent of AMCs. Proxies for raw returns are calculated as gross monthly returns plus geometric monthly average of initial charge amortized over 5 years. ≥ 20 implies that funds are required to have a minimum of 20 monthly returns to be included in the sample. Monthly total standard deviation of fund excess returns and key percentiles of the distribution of monthly excess returns are also reported.

We impose a constraint that only those funds with a minimum of 20 successive monthly returns can be included in our final samples. The minimum data requirement is set to ensure more precise and statistically meaningful estimates in our subsequent analysis. The descriptive statistics with the restriction of a minimum of 20 monthly returns do not deviate significantly from the descriptive statistics on the entire samples. This implies that the short-lived funds do not generate significantly different average monthly returns from funds with longer lives. Some papers impose a minimum of 60 observations to mitigate the impact of the higher variation in the cross section of short-lived fund returns on the accuracy of results (e.g. Kosowski et al., 2006; Goriaev, Nijman and Werker, 2008; Fama and French, 2010). Due to the comparatively shorter length of data records, we focus on monthly data and measure risk-adjusted performance either over the entire sample period or over preceding 24 or 36 months. The requirement of 20 monthly returns allows us to make use of most of the data as well as ensure proper inference. Kosowski et al. (2006) point out that the minimum return restriction might create survivorship bias. However, the difference in returns is only 20 basis points per year between the sample with and without the restriction of a minimum of 60 monthly returns. Carhart et al. (2002) further differentiate two types of survivor conditioning, survivorship bias and look-ahead bias, which can considerably bias the mutual fund performance evaluation and performance persistence tests and explain that look-ahead bias is introduced when a minimal survival period is imposed. To reduce estimation error, requiring funds to survive some minimum length of period is necessary. However, as the number of funds included in the sample declines, there is a cost of lowering precisions of parameter estimates in existence of positive look-ahead bias (Blake et al., 2014). Therefore, the inclusion criterion of a minimum of 20 monthly returns not only allows a long enough time series to generate precise estimation but also limit the impact of potential look-ahead bias.

The average gross and net monthly returns for domestic funds in our entire sample are higher than the average gross and net monthly returns reported by Blake et al. (2014) for the UK domestic equity unit trusts in their 1998-2008 sample with a constraint of a minimum of 8 monthly returns. They find a mean monthly net return, which is very close to the mean return for the FTSE All Share Index over the sample period though FTSE All Share Index return is gross of any costs and fees. In our sample, the mean monthly net return is 0.61%, which is slightly higher than the mean return of 0.56% for the FTSE All Share Index. It can be inferred that on average, domestic unit trusts slightly outperform the market over the sample period

from January 1998 to March 2015. The average gross and net monthly returns for the international funds in our sample are higher than the returns reported in Fletcher and Marshall (2005b, 2005a). However, we cannot simply conclude that UK-based international funds perform better during our sample period as we include over 177 emerging market funds. Therefore, we divide our sample into four subsamples: developed market funds, emerging market funds, globally diversified funds, and regionally focused funds[26]. Globally diversified funds subsample consists of international funds that diversify their investment portfolios globally rather than focus on specific countries and regions. Correspondingly, regionally focused funds are defined as international funds concentrate their investment in individual country or particular region, for example, Australia, Great China, Emerging Markets Europe, etc.

Table 4.4 and Table 4.5 report the descriptive statistics for the four subsamples. The average net monthly excess return for developed market funds is around 20 basis points lower than the mean net monthly return for emerging market funds. It holds when we restrict our final sample to include funds with a minimum of 20 successive monthly returns. Emerging market funds are characterized by high mean returns and high volatility. Compared to developed market funds, emerging market funds show a higher variation in returns distribution in terms of standard deviation of monthly returns and the range in the distribution of returns. In comparison to domestic funds, developed market funds exhibit higher average monthly returns even though these funds primarily invest in developed countries and regions with similar development level as the UK. However, we cannot simply conclude that developed market mutual funds outperform domestic funds without adjusting for associated risk. When we impose a minimum survival period of 20 months for funds to be included into our final sample, the resulting descriptive statistics are not significantly different from the descriptive statistics on the entire samples. In Table 4.5, globally diversified funds generate an average net monthly excess return of 0.38% while the mean net excess return for regionally focused funds is 30 basis points higher, with a value of 0.68%.

[26] Check section 4.2.4 for details of these four subsamples.

Table 4. 4: Descriptive Statistics for Developed Market Funds and Emerging Market Funds 1998.1-2015.3

	Developed Markets Funds						Emerging Markets Funds					
	Entire Sample Net Return	Entire Sample Gross Return	Entire Sample Gross Return+Initial Load	≥ 20 Net Return	≥ 20 Gross Return	≥ 20 Gross Return+Initial Load	Entire Sample Net Return	Entire Sample Gross Return	Entire Sample Gross Return+Initial Load	≥ 20 Net Return	≥ 20 Gross Return	≥ 20 Gross Return+Initial Load
Mean	0.47%	0.58%	0.66%	0.47%	0.58%	0.66%	0.66%	0.78%	0.86%	0.66%	0.78%	0.86%
Std. Dev.	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	7.07%	7.07%	7.07%	7.08%	7.08%	7.08%
Distribution of Returns												
10%	-5.71%	-5.61%	-5.53%	-5.73%	-5.62%	-5.54%	-7.79%	-7.68%	-7.60%	-7.80%	-7.70%	-7.62%
25%	-2.13%	-2.02%	-1.94%	-2.14%	-2.02%	-1.95%	-3.19%	-3.06%	-2.99%	-3.19%	-3.07%	-2.99%
50%	0.87%	0.98%	1.05%	0.87%	0.98%	1.05%	1.04%	1.16%	1.24%	1.04%	1.16%	1.24%
75%	3.40%	3.51%	3.59%	3.40%	3.51%	3.59%	4.81%	4.93%	5.01%	4.82%	4.94%	5.02%
90%	6.10%	6.21%	6.28%	6.11%	6.22%	6.29%	8.82%	8.94%	9.02%	8.84%	8.96%	9.04%
Observations	58,804	58,804	58,804	58,521	58,521	58,521	19,159	19,159	19,159	19,069	19,069	19,069
No. of Funds	480	480	480	459	459	459	177	177	177	168	168	168

Table 4.4 summarizes the monthly excess returns for developed market funds and emerging market funds over the entire sample period from January 1998 to March 2015 using the monthly return on one-month UK Treasury Bill as risk free rate of return. Net monthly returns are calculated as percentage change in bid-to-bid prices adjusted for reinvested dividends and capital gains and net of on-going operating expenses, trading costs and AMCs. Gross monthly returns are computed as net monthly returns plus monthly equivalent of AMCs. Proxies for raw returns are calculated as gross monthly returns plus geometric monthly average of initial charge amortized over 5 years. ≥ 20 implies that funds are required to have a minimum of 20 monthly returns to be included in the sample. Monthly total standard deviation of fund excess returns and key percentiles of the distribution of monthly excess returns are also reported.

Table 4. 5: Descriptive Statistics for Globally Diversified Funds and Regionally Focused Funds 1998.1-2015.3

	Globally Diversified Funds						Regionally Focused Funds					
	Entire Sample Net Return	Entire Sample Gross Return	Entire Sample Gross Return+Initial Load	≥ 20 Net Return	≥ 20 Gross Return	≥ 20 Gross Return+Initial Load	Entire Sample Net Return	Entire Sample Gross Return	Entire Sample Gross Return+Initial Load	≥ 20 Net Return	≥ 20 Gross Return	≥ 20 Gross Return+Initial Load
Mean	0.38%	0.49%	0.57%	0.38%	0.49%	0.57%	0.68%	0.80%	0.87%	0.68%	0.80%	0.87%
Std. Dev.	4.54%	4.54%	4.54%	4.54%	4.54%	4.54%	6.62%	6.62%	6.62%	6.63%	6.63%	6.63%
Distribution of Returns												
10%	-5.31%	-5.20%	-5.12%	-5.32%	-5.20%	-5.13%	-7.40%	-7.28%	-7.20%	-7.41%	-7.28%	-7.22%
25%	-1.93%	-1.82%	-1.74%	-1.94%	-1.83%	-1.75%	-2.97%	-2.85%	-2.78%	-2.98%	-2.86%	-2.79%
50%	0.83%	0.94%	1.02%	0.83%	0.94%	1.02%	1.02%	1.14%	1.21%	1.02%	1.13%	1.21%
75%	3.13%	3.24%	3.31%	3.14%	3.24%	3.32%	4.54%	4.65%	4.73%	4.55%	4.66%	4.74%
90%	5.59%	5.70%	5.78%	5.59%	5.71%	5.79%	8.32%	8.43%	8.51%	8.33%	8.45%	8.52%
Observations	42,784	42,784	42,784	42,552	42,552	42,552	35,179	35,179	35,179	35,038	35,038	35,038
No. of Funds	357	357	357	340	340	340	300	300	300	287	287	287

Table 4.5 summarizes the monthly excess returns for globally diversified funds and regionally focused funds over the entire sample period from January 1998 to March 2015 using the monthly return on one-month UK Treasury Bill as risk free rate of return. Net monthly returns are calculated as percentage change in bid-to-bid prices adjusted for reinvested dividends and capital gains and net of on-going operating expenses, trading costs and AMCs. Gross monthly returns are computed as net monthly returns plus monthly equivalent of AMCs. Proxies for raw returns are calculated as gross monthly returns plus geometric monthly average of initial charge amortized over 5 years. ≥ 20 implies that funds are required to have a minimum of 20 monthly returns to be included in the sample. Monthly total standard deviation of fund excess returns and key percentiles of the distribution of monthly excess returns are also reported.

In comparison to developed market funds, which include both globally diversified funds and part of regionally focused funds that mainly invest in a single developed country or developed region, globally diversified funds on average underperform in terms of unadjusted returns. It implies that international unit trusts that concentrate on a single developed country or region on average deliver higher mean excess returns. It can be confirmed by comparing mean excess returns generated by emerging market funds and the monthly excess returns for regionally focused funds. In our sample, 95% of the developed market funds with single country or region focus mainly invest in Asia Pacific countries. We report descriptive statistics for these Asia Pacific funds in Table 4.6. Asia Pacific funds are characterized by high mean returns and relatively low volatility. In comparison to emerging market funds, Asia Pacific funds exhibit slightly higher mean excess returns and around 1% lower standard deviations. On average, Asia Pacific funds outperform emerging market funds.

The average net monthly excess return of 0.38% for globally diversified funds is similar but slightly higher than the mean excess return of 0.334% reported by Fletcher and Marshall (2005b) for the UK-based international sector funds over the sample period 1985-2000. The average net monthly excess return of 0.66% for emerging market funds is much higher than the mean excess return of 0.148% reported by Abel and Fletcher (2004) for the UK emerging market unit trusts over the sample period 1993-2003. Apart from longer sample period covered, our sample consists of more UK unit trusts with emerging market equity objectives compared to the sample employed by Abel and Fletcher (2004), which only include 56 emerging market funds. The return volatilities for emerging market funds are similar in both samples, which are around 7% to 8%. In Abel and Fletcher (2004)'s sample, the Latin American funds exhibit higher mean excess returns than the Asia Funds while in our sample, emerging market funds that primarily invest in India and Great China[27] deliver the highest average net monthly excess returns. In particular, the 28 Great China emerging market funds in our sample are characterized as high return and low performance volatility. Funds that focus on European emerging markets generate the lowest mean excess return, which is even lower than the average net excess return for UK domestic unit trusts. In general, compared to previous literature, we find higher average monthly excess returns for UK-based international unit trusts.

[27] Great China refers to the region including Mainland China, Hong Kong, Macau and Taiwan.

Table 4. 6: Descriptive Statistics for Asia Pacific Funds 1998.1-2015.3

	Entire Sample Net Return	Entire Sample Gross Return	Entire Sample Gross Return+Initial Load	≥ 20 Net Return	≥ 20 Gross Return	≥ 20 Gross Return+Initial Load
Mean	0.70%	0.82%	0.89%	0.70%	0.81%	0.89%
Std. Dev.	6.05%	6.05%	6.05%	6.05%	6.05%	6.05%
Distribution of Returns						
10%	-6.90%	-6.79%	-6.72%	-6.92%	-6.81%	-6.74%
25%	-2.74%	-2.63%	-2.55%	-2.75%	-2.63%	-2.56%
50%	0.98%	1.10%	1.17%	0.98%	1.10%	1.17%
75%	4.27%	4.38%	4.46%	4.27%	4.39%	4.46%
90%	7.66%	7.78%	7.85%	7.67%	7.79%	7.86%
Observations	16,020	16,020	16,020	15,969	15,969	15,969
No. of Funds	117	117	117	113	113	113

Table 4.6 summarizes the monthly excess returns for Asia Pacific funds over the entire sample period from January 1998 to March 2015 using the monthly return on one-month UK Treasury Bill as risk free rate of return. Net monthly returns are calculated as percentage change in bid-to-bid prices adjusted for reinvested dividends and capital gains and net of on-going operating expenses, trading costs and AMCs. Gross monthly returns are computed as net monthly returns plus monthly equivalent of AMCs. Proxies for raw returns are calculated as gross monthly returns plus geometric monthly average of initial charge amortized over 5 years. ≥ 20 implies that funds are required to have a minimum of 20 monthly returns to be included in the sample. Monthly total standard deviation of fund excess returns and key percentiles of the distribution of monthly excess returns are also reported.

Table 4. 7: Descriptive Statistics by Investment Objective/Sector for UK Domestic, International and Developed Markets Equity Mutual Funds, 1998.1-2015.3

	Domestic			International			Developed Markets		
	UK All Companies	UK Equity Income	UK Smaller Companies	Intl. Equity Growth	Intl. Equity Income	Intl. Small&Mid Companies	Intl. Equity Growth	Intl. Equity Income	Intl. Small&Mid Companies
Mean	0.31%	0.36%	0.63%	0.51%	0.56%	0.71%	0.46%	0.56%	0.74%
Std. Dev.	4.59%	4.05%	5.63%	5.64%	3.86%	5.08%	5.06%	3.86%	4.73%
Distribution of Returns									
10%	-5.52%	-4.74%	-6.19%	-6.33%	-4.22%	-5.50%	-5.81%	-4.22%	-5.37%
25%	-1.94%	-1.52%	-2.12%	-2.41%	-1.37%	-1.74%	-2.17%	-1.37%	-1.52%
50%	0.88%	0.85%	1.14%	0.90%	0.83%	1.15%	0.86%	0.83%	1.17%
75%	2.96%	2.75%	3.86%	3.75%	3.03%	3.64%	3.42%	3.03%	3.53%
90%	5.33%	4.80%	8.45%	6.77%	4.99%	6.24%	6.16%	4.99%	6.03%
Observations	52,707	19,352	11,947	73,764	2,857	1,342	54,834	2,857	1,113
No. of Funds	437	155	76	607	36	14	433	36	11

Table 4.7 summarizes the net monthly excess returns for UK domestic, international and Developed Markets equity mutual funds by investment objective or sector over the entire sample period from January 1998 to March 2015 using the monthly return on one-month UK Treasury Bill as risk free rate of return. Net monthly returns are calculated as percentage change in bid-to-bid prices adjusted for reinvested dividends and capital gains and net of on-going operating expenses, trading costs and AMCs. Monthly total standard deviation of fund excess returns and key percentiles of the distribution of monthly excess returns are also reported.

Table 4.7 presents the average monthly excess returns over the sample period from January 1998 to March 2015 by investment objective for UK domestic, international and developed market equity mutual funds respectively. The three fund sectors for UK domestic unit trusts are defined by Investment Association. Similarly, UK-based international unit trusts are classified into three "sectors" in terms of their investment strategies and objectives instead of geographical focus, which are International Equity Growth, International Equity Income and International Small&Mid Companies[28]. Consistent with previous literature (e.g. Blake and Timmermann, 1998), for UK domestic unit trusts, UK Smaller Companies funds have the highest average net monthly excess return while UK All Companies sector has the smallest mean net excess return. The mean net excess return for UK Equity Income sector is slightly higher compared to UK All Companies sector but much smaller than the mean net excess return for UK Smaller Companies sector. Under a similar classification based on investment objective and investment style, difference in the performance of each of the three categories of international equity mutual funds is observed. International Small&Mid Companies funds have the highest average net monthly excess return while international Equity Growth sector shows the smallest mean excess return. International Equity Income funds have an average net monthly excess return of 0.56%, which is the second highest performance among the three sectors. For each sector of UK domestic unit trusts, the corresponding international fund sector consistently has higher raw returns. However, we cannot simply conclude that international unit trusts outperform domestic unit trusts over our sample period, as the returns we discuss are not adjusted for associated risk. Higher excess returns are normally observed with higher performance volatility, which support the use of risk-adjusted returns in fund performance and performance persistence tests.

Table 4.8 and Table 4.9 report the descriptive statistics on fund size and fund flows for UK domestic and international unit trusts respectively[29]. In Table 4.8, the mean monthly fund size across the entire sample for UK domestic unit trusts is £274.2 million. The average monthly fund size does not increase monotonically from 1998 to 2014. It generally responds to economic expansions and contractions. During 2003 and 2004, the average monthly fund size drops to £193.7 million as the dot.com bubble burst and the market touched bottom in 2003.

[28] Check section 4.2.4 and Table 4.1 for details of fund classifications.

[29] See Figure 4.1 in Appendix for more information.

The period 2008-2010 witnesses another drop in the average monthly fund size for domestic unit trusts, presumably due to the eruption of the 2008 financial crisis. This trend is also consistent with the evidence on funds held by UK retail investors documented in the annual report published by Investment Association[30] (Investment Association, 2016). The median fund size is much smaller than the mean fund size, which indicates that our sample includes many small domestic unit trusts and some very large funds. The large standard deviations of the mean fund sizes after 2005 also reflect that fund size varies greatly in our sample. A domestic trust in our sample experience a negative monthly net flow of -0.30% of its total asset, which translates into a monthly average of £0.839 million pounds of absolute outflows per fund. The average net outflows start from 2007, peaking in 2008 and fluctuating around -0.7% afterwards. In general, the mean monthly net fund flows are not significantly affected by any outliers with extremely large positive or negative values as we winsorize the monthly net fund flows at 0.5^{th} and 99.5^{th} percentiles. It seems that after 2008, UK domestic unit trusts become less attractive to retail investors. According to Investment Association (2016), retail investors continue to shift their investments towards outcome-oriented funds and show a great interest in Absolute Return funds, which attract substantial net new money injection. It is worth noting that a positive mean monthly relative flow does not necessarily imply a positive mean monthly absolute flow as funds with very large total assets can significantly impact absolute flow calculation. Therefore, fund flows measured relative to the fund size is widely used as the basis for statistical inference in fund flow-performance literature as it allows comparison between funds with different sizes.

[30] Investment Association changed its way of reporting fund data from a UK domiciled basis to a UK investor basis in 2016.

Table 4. 8: Summary Statistics of Fund Size and Fund Flow for UK Domestic Equity Unit Trusts

	1998-2002	2003-2004	2005-2007	2008-2010	2011-2014	1998.1 – 2015.3
No. of Funds	431	467	520	496	473	668
Monthly Fund Size (million £)						
Mean	218.7	193.7	293.2	266.1	349.7	274.2
Std. Dev.	340.8	353.7	617	711.8	1,019	700
25th percentile	29.05	20.6	34.6	25.06	22.06	26.84
Median	93	69.3	105.2	73.47	91.4	87.26
75th percentile	248.3	214.6	287.3	218.7	285.5	254.5
Monthly Relative Net Flow						
Mean	0.65%	0.15%	-0.37%	-0.89%	-0.61%	-0.30%
Std. Dev.	11.70%	11.80%	11.50%	12.00%	10.80%	11.60%
25th percentile	-1.57%	-1.32%	-1.49%	-1.69%	-1.54%	-1.55%
Median	-0.18%	-0.36%	-0.49%	-0.60%	-0.66%	-0.49%
75th percentile	1.78%	1.12%	0.78%	0.38%	0.29%	0.77%
Monthly Absolute Net Flow (million £)						
Mean	0.209	-0.203	-0.621	-1.181	-1.750	-0.839
Std. Dev.	15.770	10.94	14.81	13.39	14.740	14.33
25th percentile	-1.425	-1.276	-2.084	-1.815	-2.015	-1.782
Median	-0.078	-0.123	-0.268	-0.262	-0.337	-0.218
75th percentile	1.376	0.48	0.481	0.13	0.061	0.376

Table 4.8 reports summary statistics of fund size and fund flow for UK domestic unit trusts/OEICs. Monthly mean and corresponding standard deviation as well as key percentiles are reported. Fund size and absolute fund flows are in millions of GBP.

Table 4. 9: Summary Statistics of Fund Size and Fund Flow for UK-based International Equity Unit Trusts

	1998-2002	2003-2004	2005-2007	2008-2010	2011-2014	1998.1 – 2015.3
No. of Funds	273	311	451	551	603	657
Monthly Fund Size (million £)						
Mean	90.63	111.8	166	189.1	229.2	180.9
Std. Dev.	134.8	252.5	323.8	419.7	543.8	423.2
25th percentile	19.11	14.83	14.65	9.5	9.4	12.14
Median	48.34	45.38	53.75	41.84	45.95	46.93
75th percentile	106.2	119.7	169.7	184	210	166.8
Monthly Relative Net Flow						
Mean	1.46%	1.42%	1.73%	1.27%	-0.23%	0.78%
Std. Dev.	14.40%	13.10%	14.10%	15.30%	12.50%	13.80%
25th percentile	-1.32%	-1.21%	-1.24%	-1.26%	-1.83%	-1.51%
Median	-0.14%	-0.17%	-0.15%	-0.16%	-0.62%	-0.32%
75th percentile	2.09%	1.76%	1.88%	1.72%	0.51%	1.31%
Monthly Absolute Net Flow (million £)						
Mean	0.611	0.324	0.317	0.532	-1.135	-0.174
Std. Dev.	10.900	9.362	11.71	12.070	12.6	11.860
25th percentile	-0.608	-0.615	-0.688	-0.584	-1.19	-0.808
Median	-0.036	-0.033	-0.018	-0.010	-0.121	-0.053
75th percentile	0.843	0.544	0.871	0.573	0.083	0.415

Table 4.9 reports summary statistics of fund size and fund flow for UK-based international equity mutual funds. Monthly mean and corresponding standard deviation as well as key percentiles are reported. Fund size and absolute fund flows are in millions of GBP.

In Table 4.9, the mean monthly fund size across the entire sample for UK-based international equity unit trusts is £180.9 million. The average monthly fund size increases monotonically from 1998 to 2014, though the growth rate of the mean funds size declines after 2008. It reflects an increasing tendency for UK retail investors to pursue international diversification and new growth opportunities in markets and regions outside the UK, which is in accordance with the evidence of consistently increasing market share of non-UK equity funds (Investment Association, 2016). The median fund size is much smaller than the mean fund size, which indicates that our sample includes many small international unit trusts and some exceptionally large international funds. The mean monthly relative fund flow across the entire sample is 0.78%. Compared to domestic trusts, international funds on average experience positive and higher relative fund flows as well as less absolute fund outflows. The mean monthly relative and absolute fund flows are always positive in most years during the sample expect for the period of 2011-2014. The average fund suffers from fund outflows following substantial deterioration in fund performance after 2008 financial crisis. The mean monthly absolute outflow after 2010 is so large that it has a significant negative effect on the average monthly absolute fund flow across the entire sample. However, once the absolute fund flow is measured relative to fund size, the relative fund flow becomes positive.

Table 4.10 and Table 4.11 displays the descriptive statistics on fund age, total expense and fund family size for UK domestic and international unit trusts respectively. On average, UK domestic unit trust is older than international unit trusts, which implies that the average domestic fund can provide a longer record of performance history. In comparison to domestic funds, the fund age of international funds is less dispersed in terms of smaller standard deviation. We define total expense as the sum of AMC and initial load annualized over five-year holding period, which is similar to the total shareholder cost defined by Khorana, Servaes and Tufano (2008). The mean monthly total expense is stable during our sample period for domestic and international funds, though international funds charge a higher total fee than domestic trusts. Due to the limited data we have with respect to AMCs and front-end loads for both types of funds, especially UK-based international unit trusts, we assume that fund fees stay unchanged during our sample period and fill in the missing values with the median fund fees of all other funds classified in the same fund scheme and size quintile. The mean monthly fund family size for UK domestic unit trusts is £2012 million compared to £1772 million for international unit trusts. Since the fund family size is computed as the sum

of total net asset of all funds that belongs to the same fund family, the mean monthly fund family size shows a similar trend as the mean monthly fund sizes for both types of funds. However, the total number of fund families as well as the mean number of funds sold by each fund family in the domestic sample is very close to those in the international sample.

Table 4. 10: Summary Statistics of Major Fund Characteristics for UK Domestic Unit Trusts/OEICs

	1998-2002	2003-2004	2005-2007	2008-2010	2011-2014	1998.1 – 2015.3
No. of Funds	431	467	520	496	473	668
Fund Age						
Mean	13.37	13.3	13.81	14.84	16.36	14.5
Std. Dev.	10.6	11.39	11.82	12.2	12.62	11.84
25th percentile	4.605	3.552	4.134	5.047	6.338	4.915
Median	11.51	10.45	10.17	10.84	12.45	11.42
75th percentile	18.43	19.1	20.41	22.43	24.85	21.42
Monthly Total Expense						
Mean	0.18%	0.18%	0.19%	0.19%	0.19%	0.19%
Std. Dev.	0.04%	0.03%	0.03%	0.03%	0.03%	0.03%
25th percentile	0.17%	0.17%	0.18%	0.19%	0.18%	0.17%
Median	0.19%	0.20%	0.21%	0.21%	0.21%	0.20%
75th percentile	0.21%	0.21%	0.21%	0.21%	0.21%	0.21%
Fund Family Size (million £)						
Mean	1,321	1,698	2,621	2,113	2,639	2,102
Std. Dev.	1,309	1,774	2,920	2,875	3,690	2,784
25th percentile	290.5	359.2	518.7	316.7	335.3	328.8
Median	807.2	969.7	1,711	1,142	1,236	1,150
75th percentile	2,149	2,372	3,631	2,951	4,304	2,877
No. of Fund Families	89	93	101	98	94	110
No. of Funds Sold/ Fund Family						
Mean	9.07	10.01	10.48	9.45	9.52	13.02
Std. Dev.	5.45	6.64	6.94	5.55	5.88	9.21
Smallest	1	1	1	1	1	1
Largest	21	24	29	22	24	37

Table 4.10 reports summary statistics of fund age, monthly total expense, fund family size and the number of funds sold per fund complex for UK domestic unit trust/OEICs. Monthly mean and corresponding standard deviation as well as key percentiles are reported. Monthly total expenses are computed as the sum of monthly equivalent of AMCs and geometric monthly average of initial loads amortized over 5 years. Fund family size is in millions of GBP.

Table 4. 11: Summary Statistics of Major Fund Characteristics for UK-based International Equity Mutual Funds

	1998-2002	2003-2004	2005-2007	2008-2010	2011-2014	1998.1 – 2015.3
No. of Funds	273	311	451	551	603	657
Fund Age						
Mean	10.34	11.08	10.82	10.81	12.09	11.23
Std. Dev.	9.998	10.17	10.34	10.45	10.74	10.47
25th percentile	3.738	3.759	3.082	3.019	4.603	3.77
Median	8.148	8.967	8.304	7.726	8.397	8.304
75th percentile	13.68	15.68	16.17	16.1	17.73	15.99
Monthly Total Expense						
Mean	0.19%	0.19%	0.19%	0.19%	0.19%	0.19%
Std. Dev.	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%
25th percentile	0.19%	0.19%	0.19%	0.19%	0.19%	0.19%
Median	0.21%	0.20%	0.21%	0.21%	0.21%	0.21%
75th percentile	0.21%	0.21%	0.21%	0.21%	0.21%	0.21%
Fund Family Size (million £)						
Mean	344.9	891.6	1,618	2,035	2,625	1,772
Std. Dev.	392	948.8	1,751	2,305	3,146	2,424
25th percentile	38.18	136.7	208.4	206	193.1	156.2
Median	224.4	472.6	727.9	870.1	1,254	647.7
75th percentile	461.5	1,378	2,652	3,424	3,995	2,689
No. of Fund Families	70	76	87	93	99	111
No. of Funds Sold/ Fund Family						
Mean	8.66	8.99	11.46	13.07	13.40	14.32
Std. Dev.	6.49	6.67	8.07	8.79	8.81	9.77
Smallest	1	1	1	1	1	1
Largest	23	24	28	29	31	34

Table 4.11 reports summary statistics of fund age, monthly total expense, fund family size and the number of funds sold per fund complex for UK-based international equity mutual funds. Monthly mean and corresponding standard deviation as well as key percentiles are reported. Monthly total expenses are computed as the sum of monthly equivalent of AMCs and geometric monthly average of initial loads amortized over 5 years. Fund family size is in millions of GBP.

Chapter 5 Mutual Fund Performance

5.1 Introduction and Hypotheses

Mutual funds and unit trusts, as professionally managed investment vehicles, provide investors with the opportunity to invest in well-diversified portfolios, which are constructed in accordance with various specified investment objectives. Recently, especially after the 2008 financial crisis, there has been an increased investor reliance on mutual funds in the changing financial market. Whether fund managers possess sufficient ability to generate abnormal returns remains of great interest to both practitioners and researchers. In addition to the empirical implications, research on mutual fund performance and fund manager skill also contribute to the theoretical basis including rational expectation theory, market efficient hypothesis and psychology-based theories proposed by scholars of behavioral finance. While most existing literature on mutual fund performance and active management focuses on domestic mutual funds and US fund industry, there is a demand for studies of internationally diversified investment schemes and in markets other than the US (either other developed or emerging markets). The increased degree of international integration has promoted capital flows across the world, identifying profitable investment opportunities. Funds have flowed into these different markets especially emerging markets that fund investors believe exhibit higher inefficiencies than developed markets. The research on international equity mutual funds and non-US markets also contributes to modern portfolio theory with respect to whether diversification internationally adds value and the efficient market hypothesis by gaining international evidence on whether active management adds value in mostly efficient markets.

A small number of studies have been conducted on international mutual funds. As we have discussed in Chapter 4, one challenge for evaluating the performance of international equity mutual fund is constructing appropriate risk factors that can be applied in performance measurement models. More recent studies suggest constructing international versions of size, value and momentum factors to explain the cross-section of returns (e.g. Fama and French, 1998; Griffin, 2002; Gregory and Whittaker, 2007; Chua, Lai and Wu, 2008; Hou, Karolyi and Kho, 2011; Cortez, Silva and Areal, 2012; Fama and French, 2012; Ferreira et al., 2012; Busse, Goyal and Wahal, 2013). Some recent papers favor local versions of factor models for

each geographical region rather than a global version of multi-factor model as evidence on asset pricing integration across regions has been found (e.g. Griffin, 2002; Hou, Karolyi and Kho, 2011; Fama and French, 2012). To minimise the impact of exchange rates, some scholars advocate constructing risk factors for each country using local currency first and then derive regional risk factors (Ferreira et al., 2012). Other scholars directly use US risk factors, which are translated into local currency using appropriate exchange rate as proxies for the world factors. Just like the long-term controversy over the right asset-pricing model, there is little consensus about the correct way to construct regional and global risk factors for international fund performance measurement (Busse, Goyal and Wahal, 2013). Another challenge for fund research is the databases one can assess in non-US markets. Despite the fact that the US is the largest source of conventional funds under management, an important explanation for most fund research having been conducted on US mutual funds is that there is a large survivorship bias free database that academia can access. The UK fund management industry, as the world second largest fund market with relatively easy access to extensive data, on the other hand, has drawn much less attention. Our research contributes to existing literature by investigating three research questions: 1) whether actively managed UK domestic and international equity mutual funds can generate abnormal returns for investors, 2) whether UK domestic and international funds perform when it matters most to investors in a down-market, and 3) whether the abnormal performance generated by individual funds stem from superior managerial skill possessed by active fund managers or purely due to luck.

All funds included in our sample are retail funds, which means our research is designed to unveil the benefits for individual investors rather than institutional investors from investing in mutual funds. We follow the usual convention to use net returns, which are calculated from bid-to-bid prices with dividends reinvested. These returns are gross of investor level taxes on dividends and capital gains and net of any other costs incurred including management fees, on-going operating and trading costs[31]. Therefore, if positive abnormal performance is found, it implies that fund managers have sufficient ability to generate abnormal returns, which can cover all the costs except for personal tax for retail investors. In this chapter, we measure the performance of UK domestic and international equity mutual funds separately and analyze

[31] According to Blake et al. (2014), operating costs include expenses on administration, record-keeping, research, custody, accounting, auditing, valuation, legal costs, regulatory costs, distribution, marketing and advertising. Trading costs include commissions, spreads and taxes.

whether there is evidence of significant outperformance for either type of mutual funds.

Under the null hypothesis of efficient markets, we expect no outperformance of both domestic and international funds. Although investors might anticipate potential benefits from international diversification by investing in collective investment schemes with global investment objective, fund managers with domestic focus that have informational advantages in local markets are more likely to outperform in a world with no fear of exchange rate fluctuations and less barriers to investment. If international mutual funds achieve superior performance, it might suggest that international diversification adds value, or fund managers with international focus benefit from informational inefficiency in emerging markets. If domestic funds outperform international funds, this might imply either informational advantages or superior stock picking and market timing skill possessed by domestic fund managers. If there is no evidence of outperformance of both type of funds, there are four possible explanations: 1) both domestic and international markets are mostly informational efficient so that the average fund cannot beat the market, 2) fee charges extract the abnormal returns generated by fund managers and leave nothing to investors, 3) during a sample period that experiences a severe global financial crisis, it is difficult for the average fund to deliver good performance since the global fund industry as a whole is adversely affected, and 4) there is a lack of management skill for most fund managers and they are not able to exploit market inefficiency and gain profit from identifying and investing in underpriced stocks. To test the last two predictions, we further examine the performance of UK domestic and international mutual funds in different market conditions and analyze individual fund manager skill applying bootstrap simulations. Despite of the null hypothesis that no abnormal returns are generated by the average fund, for individual funds, we expect that there exist fund managers who have sufficient skill to outperform but it limits to a small number of top performers.

With respect to domestic mutual fund performance, while an average underperformance of actively managed mutual funds after fees and expenses is widely documented in literature (e.g. Carhart, 1997; Blake and Timmermann, 1998; Quigley and Sinquefield, 2000; Bessler et al., 2010; Fama and French, 2010), contradictory findings suggest that active management adds value (e.g. Hendricks, Patel and Zeckhauser, 1993; Stephen J Brown and Goetzmann, 1995; Kosowski, 2011; Blake et al., 2014). Blake and Timmermann (1998) examined UK mutual fund performance using a sample covering 23 years and consisting of 2,300 UK open-ended mutual funds. They found evidence of underperformance for the average fund on a

risk-adjusted basis, though insignificant. Quigley and Sinquefield (2000) applied UK version of Fama-French three-factor model to a sample covering 20 years and found that on average, fund managers significantly underperform the market. These findings were confirmed by Cuthbertson, Nitzsche and O'Sullivan (2008) and Blake et al. (2014) who documented little evidence of outperformance for UK domestic mutual funds using alternative factor models. Cuthbertson, Nitzsche and O'Sullivan (2008) and Blake et al. (2014) further analyze the tails of performance distribution using bootstrap simulations following the approach proposed by Kosowski et al. (2006) and Fama and French (2010). Their results suggested that after deducting management fees, there were only a few fund managers who have true skill to generate abnormal performance. Most positive alphas were achieved merely due to luck and a large number of the worst performing funds were managed by unskilled rather than merely unlucky fund managers. With respect to international mutual fund performance, most existing studies focus on US-based international equity mutual funds and the research is less extensive as research on domestic equity mutual funds. Like their domestic counterparts, the evidence on whether international equity mutual funds can outperform the benchmark is mixed. Outperformance of international mutual funds was documented by Gallo and Swanson (1996), Detzler and Wiggins (1997), Fortin and Michelson (2002), Fortin and Michelson (2005), Rao, Ward and Ward (2007) and Fan and Addams (2012). Contrary findings suggest that foreign and global funds show little evidence of positive average abnormal returns (e.g. Cumby and Glen, 1990; Engström, 2003; Fletcher and Marshall, 2005b; Comer and Rodriguez, 2012; Busse, Goyal and Wahal, 2013; Breloer, Scholz and Wilkens, 2014). Cheney, Atkinson and Bailey (1992) compared the performance of US-based international mutual funds with UK-based international investment unit trusts and concluded that UK-based international unit trusts delivered superior risk-adjusted performance than US international funds. They also warned that the results might not be representative in terms of the sample size and selective sample period and US investors should be cautious when pursuing UK-based international mutual funds if taking exchange rate fluctuations into consideration. Fletcher and Marshall (2005b) evaluated the performance of UK-based international equity unit trusts with a larger sample that contained 282 funds and covered a period from January 1985 to December 2000. They compared results based on the law of one price performance measure with findings obtained from unconditional Jensen alphas and Ferson and Schadt conditional performance measures. They concluded that UK-based

international unit trusts provided little evidence of superior performance relative to domestic benchmark. In addition, less favourable performance was documented for the law of one price measure than for Jensen and Ferson and Schadt measure and the performance based on the former measure was affected by investment sector and fee charges.

Ferreira et al. (2012) conducted a cross-country study on mutual fund performance around the world. Although this work focuses on individual countries and domestic equity mutual funds, the findings are very relevant to our research. They found that on average, equity mutual funds around the world underperform after deducting fees and controlling for risk, and more importantly the widely documented diseconomies to scale identified in US studies does not apply to most non-US countries. This has significant implications for Berk and Green (2004)'s model as they attributed the lack of persistence in performance of mutual funds to a combined effect of large capital inflows and decreasing returns to scale. Since the literature on UK-based international mutual funds is quite limited, we mainly compare our results to US findings, and in particular Busse, Goyal and Wahal (2013), which has a similar structure to ours. Busse, Goyal and Wahal (2013) conducted a comprehensive study on a sample of retail and institutional US-based international equity mutual funds covering a 19-year period from 1991 to 2009 and found no evidence of positive alphas. They also applied bootstrap simulations to study the tails of performance distributions and attributed the large alphas in the right tail to luck rather than manager skill.

In our research, we attempt to conduct a comprehensive test for Berk and Green (2004) model. Berk and Green (2004) argued that even if fund managers have superior skill, persistence in mutual fund performance would not be observed due to decreasing returns to fund management. When investors chase past performance, the size of a successful mutual fund grows to a long run equilibrium point where diseconomies of scales offsets the abnormal returns from the higher skills, and as a result performance persistence is dissipated. The level of persistence in a fund industry depends on how close it is to its long run equilibrium point. This Berk and Green (2004) equilibrating mechanism works under three conditions. Firstly, there are a number of fund managers who are able to generate abnormal returns. Secondly, investors chase past performance, as they believe that they can distinguish skilled managers in terms of the information contained in the history of fund performance. The last but not the least, decreasing returns to scale from fund flows intervene, leading to unpredictability of future performance. Our three empirical chapters are structured to investigate whether each of

the three conditions applies to UK domestic and international equity mutual funds. In the first empirical chapter, we will concentrate on the performance of UK domestic and international equity mutual funds and attempt to identify the existence of individual manager skill.

Having reviewed the related literature and highlighted the gaps to be filled in this research field, the hypotheses to be tested in this chapter are as follows.

Hypothesis 1: *On average, actively managed UK domestic equity unit trusts and UK-based international equity unit trusts do not generate significant outperformance above a benchmark.*

For any given period of time, the market return equals to the value weighted average return from all securities that constitute the market. Since the market is comprised of passive investors and active investors, the market return is a weighted average of the returns achieved by these two groups of investors (Sharpe, 1991). The gross return obtained by all passive investors in the market equals to the market return. Thus, the average return achieved by active investors must equal the gross return acquired by the passive investors in a market, that is, the market return (Sharpe, 1991). However, in a mostly efficient market, active management requires more frequent rebalancing of the holdings as the investors' assumptions of mispricing change quite often. As a result, buying and selling activities incur more transaction costs than pure passive investing. Besides, active fund managers tend to charge higher fees than passive fund managers to fund their research to identify mispriced securities. Therefore, equilibrium accounting suggests that on average, the net return achieved from active management must be lower than the net return obtained from passive investments (Grossman and Stiglitz, 1980; Fama and French, 2010). The active investors who receive abnormal returns must do so at the expense of other investors (Fama and French, 2010). The same equilibrium accounting argument not only applies to domestic market but also can be extended to a global context. Although investors might expect that international diversification adds value or fund managers with international focus benefit from informational inefficiency in emerging markets, the average active international funds will not outperform.

Following the usual convention, we use returns, which are calculated from bid-to-bid prices with dividends reinvested and net of any costs incurred including management fees, on-going operating and trading costs (Blake et al., 2017). Therefore, if positive abnormal performance

is found, it implies that fund managers have sufficient ability to generate abnormal returns, which can cover all the costs except for personal tax for retail investors. It contrasts the EMH and indicates that the market is informationally inefficient. However, if the empirical evidence in this thesis suggests no abnormal returns on average, it does not imply that there is no managerial skill at individual fund level. Some managers might have sufficient skill to generate abnormal gross returns. However, they extract the abnormal performance via fees and leave nothing to individual investors.

Hypothesis 2: *On average, there is no significant difference in performance between UK domestic and international equity mutual funds.*

Both UK domestic and international unit trusts, as professionally managed investment vehicles, provide investors with the opportunity to invest in well-diversified portfolios. In particular, international diversification might achieve extra reduction in systematic risk of investment portfolios, as the systematic risk factors are not perfectly correlated across different countries. Although investors anticipate potential benefits from international diversification, which cannot be achieved from investing in funds with domestic or local focus only, fund managers with domestic focus might have informational advantages in local markets and achieve superior performance in a market where they do not have to deal with difficulties including restrictions on international capital flows, exchange rate risk fluctuations, asymmetric information, and time lags. Under the assumption of market efficiency, we anticipate that there is no difference in the average performance between international and domestic mutual funds. However, if international mutual funds achieve superior performance, it might suggest that international diversification adds value, or alternatively, fund managers with international focus benefit from informational inefficiencies in emerging markets. On the other hand, if domestic funds outperform international funds, this might imply either informational advantages or superior stock picking and market timing skill possessed by domestic fund managers. Even if some international funds earn abnormal returns from exploiting informational inefficiencies in emerging markets, the higher fee charges of international funds relative to domestic unit trusts might result in no differential in net returns to retail investors between funds with international and domestic investment objectives.

Hypothesis 3: *Mutual fund managers perform better in a recession, and a corollary is that UK domestic and international equity mutual funds will outperform the market in recessions*

and post the 2008 financial crisis.

Investors expect to benefit from active management when performance matters most to them, that is, in recessions. In a bear market, a passive strategy performs as bad as the market while an active strategy, as suggested in recent literature, is able to generate abnormal returns to investors (e.g. Kosowski, 2011). Kosowski (2011) even points out that the aggregate underperformance of active fund managers is largely due to the underperformance of active funds during expansion periods. Manager skill is also time-varying as stock picking skills are commonly detected in expansions while market timing skill presents mostly in recessions (Kacperczyk, Nieuwerburgh and Veldkamp, 2014). In addition to evaluate the performance of UK domestic and international equity mutual funds for the whole sample period, we also test whether the average fund performance varies over time, especially during the 2008-2009 financial crisis. If the empirical evidence suggests that UK domestic equity unit trusts earn abnormal returns in recessions, investors might be better off by switching into domestic assets in a bear market. Otherwise, international diversification would be preferred.

Hypothesis 4: *For UK domestic equity mutual funds, fund performance declines with fund size while for UK-based international equity mutual funds, fund size does not erode performance.*

There is a widely documented diseconomies to scale in US domestic mutual funds. This finding has significant implications for Berk and Green (2004)'s model as they attribute the lack of persistence in mutual fund performance to a combined effect of large capital inflows and decreasing returns to scale. We anticipate that lagged fund size is inversely correlated to the performance of domestic unit trusts due to the organizational diseconomies of scale, liquidity constraints and limited domestic investment opportunities. As fund size increases, domestic fund managers who have to find good investment opportunities continuously to maintain their good performance record might be confronted with limited domestic investment opportunities and suffer from diluted skill (Ferreira et al., 2013a). The large trading volume that has greater impact on the price of underlying assets in domestic markets also introduces higher trading costs (Joseph Chen et al., 2004). Unlike small domestic funds, which are more active and good at processing soft information that requires fund managers to make their own judgments instead of depending solely on quantitative analysis, most large domestic funds choose to scale up their investment positions rather than exploiting new

profitable assets (Pollet and Wilson, 2008). This might result in decreasing returns to scale in UK domestic unit trusts. By contrast, active UK-based international mutual funds without the restriction of investing more than 80% of their fund in domestic assets face less difficulties in exploring new investment opportunities and have more incentive to diversify into new assets and exploit market inefficiency in oversea markets, as one of the main investment objectives of international fund investors is to achieve global diversification. Besides, large international mutual funds also attract more skillful fund managers who are able to deliver superior performance because of economies of scale (Fan and Addams, 2012). Although the large trading volume might introduce higher transaction costs for international capital flow, the increase in the fund size of international mutual funds may not necessarily lead to deterioration in future fund performance.

Hypothesis 5: *For both domestic and international equity mutual funds in UK, managerial skill exists amongst a small number of active fund managers.*

The average underperformance of mutual funds does not imply that there are no individual funds outperform the market or there is a lack of superior managerial skills for all fund managers. Fund manager skills exit but are limited to a small number of top performers on the assumption that the market is mostly efficient (Kosowski et al., 2006; Cuthbertson, Nitzsche and O'Sullivan, 2008; Blake et al., 2017). Kosowski et al. (2006) found that while most fund managers failed to deliver superior performance, there were a small number of skilled fund managers who are capable of generating abnormal returns. However, it is hard to tell whether the superior or inferior performance is a true reflection of manager skills or merely due to luck. In a recent research, Blake et al. (2017) compare the different bootstrap methods utilized by Kosowski et al. (2006) and Fama and French (2010) using the same dataset with the same survival rule and find evidence of small group of skilled managers in terms of gross returns following Kosowski et al. (2006)'s methodology. Their results suggest that although skillful managers generate abnormal gross returns, they extract the abnormal performance via fees and leave nothing to investors. Since our analysis of manager skill is based on net returns, the null hypothesis of zero true alpha implies that manager of each individual fund is capable of generating abnormal returns that covers all associated costs.

5.2 Methodology and Data

5.2.1 Methodology

We assess the performance of mutual fund i by regressing the excess return $R_{i,t} - R_{f,t}$ in time t on a series of predetermined risk factors.[32] We apply three different benchmark models: unconditional CAPM/single factor model, the Fama and French three-factor model, and the Carhart four-factor model. These unconditional factor models mainly capture the stock-picking skill of fund managers. Treynor and Mazuy (1966) argued that managers might anticipate market movements and adjust their investment portfolio accordingly to protect themselves against adverse conditions. This means that investment managers should invest in stocks exposed more to market factors in a bull market and switch to defensive stocks that do not co-move with the market in bear markets. To jointly measure stock selection and market timing skills, we add a quadratic term in the market excess return to each of the three factor models to capture the non-linearity in fund performance and fund manager's market timing skill. Following Blake and Timmermann (1998) and Blake et al. (2017), we regress the excess returns of equal-weighted portfolio and value-weighted portfolio of all funds in each time period t against the multi-factor models to test the average fund performance. The methodologies for measuring fund performance have been discussed in section 4.1.

The international risk factors we use in this research are constructed for developed markets by Fama and French (2012). They argue that the global risk factors have less explanatory power over investments with obvious region orientation. Therefore, we expect that the risk factors we apply for emerging market funds might not be able to fully capture the cross–sectional variation in fund returns. To minimize the negative impact, we draw a sample consisting of all developed market funds and repeat all the tests to this sample for robustness check. In our research, we have no intention to judge which model is superior in measuring performance or how appropriate the model is to measure risk factors. It is just relatively easier and costless for investors to follow the strategy specified by the risk factors and implement the zero investment portfolios with expectation of achieving abnormal returns after deducting any expenses and costs. Therefore, we just use these factor models especially Carhart four-factor

[32] We don't use the widely applied conditional models proposed by Ferson and Schadt (1996) because we have no access to the publicly available information for UK-based international mutual funds such as lagged term structure and market index dividend yield.

model, a standard performance measure used in recent literature, to assess whether active fund managers can beat the benchmark under the null hypothesis of no abnormal performance.

To address the widely documented non-normality in the time-series returns of individual mutual funds and allow comparison with previous evidence on skill and luck (e.g. Kosowski et al., 2006; Cuthbertson, Nitzsche and O'Sullivan, 2008; Blake et al., 2017), we use the bootstrap methods employed by Fama and French (2010)[33] to measure individual fund performance and draw inference on manager skill. This approach estimates sampling distribution of alphas and corresponding t-statistics through resampling the full cross section of returns and then draw comparisons between the sampling distribution and actual distribution to get statistical inference on luck and skill. Fama and French (2010) argued that this resampling method maintains the cross-correlation of fund returns.

We base the statistical inference on t-statistic of alpha rather than alpha since t-statistics has advantageous statistical property compared to alphas and provide relatively robust inference in the presence of survivorship bias (Stephen J Brown et al., 1992; Cuthbertson, Nitzsche and O'Sullivan, 2008; Busse, Goyal and Wahal, 2013). We will focus on results based on net returns though in unreported analysis, we also run simulations based on gross returns, which are defined as returns net of all on-going operating and trading costs but gross of management fees. Fama and French (2010) pointed out that tests of null hypothesis of zero alpha based on different types of returns imply different assumptions of managerial skills. For net returns, the null hypothesis of zero true alpha implies that manager of each individual fund can generate abnormal returns that covers all associated costs while the null hypothesis of zero true alpha in gross returns indicates that each manager has sufficient skill to cover all the other costs except for management fees. With respect to model selection, Cuthbertson, Nitzsche and O'Sullivan (2008) identify the best model using the Schwartz Information Criteria (SIC). We choose Carhart four-factor model as our base model for bootstrap simulations as it is a standard model in fund performance studies and allows for comparisons with existing evidence.

[33] We also applied Kosowski et al. (2006) bootstrap method to measure individual fund manager skill for robustness. The results obtained from employing the residual resampling procedure are very similar to the results reported in section 5.3.4.

5.2.2 Data

The data used in our research include 668 UK domestic unit trusts and 657 UK-based international equity mutual funds, which are all available to retail investors. Monthly returns are calculated as percentage change in bid-to-bid prices adjusted for reinvested dividends and capital gains over a period from January 1998 to March 2015. They are reported net of on-going operating and trading costs as well as management fees. Information on investment objective, fund size, initial charge, exit charge, annual management fees, and parent company of each fund are also acquired. We restrict a minimum of 20 consecutive months of return data for funds to be included in analysis. This results in a final sample of 650 UK domestic unit trusts and of 627 UK-based international equity unit trusts. A detailed description of the dataset employed as well as discussion of potential survivorship bias can be found in section 4.2.

5.3 Empirical Results

5.3.1 Average Fund Performance

Table 5.1 reports the alphas of equal-weighted and value-weighted portfolios of all funds as well as funds in each IMA sector estimated over the sample period from January 1998 to March 2015 by employing unconditional CAPM, Fama-French three-factor and Carhart four-factor models for UK domestic and international equity mutual funds respectively. In general, there is no significant evidence of abnormal performance across entire samples of domestic and international equity mutual funds based on all three-factor models. The alpha estimates for the entire samples of both domestic and international funds are mostly positive but insignificant irrespective of factor models employed. It is worth noting that although the evidence of outperformance for domestic and international funds is not statistically significant, international funds in general outperform domestic funds before and after adjusting for risk exposure. Across all investment objectives, there is no evidence of abnormal performance for UK domestic and international mutual funds. The alpha estimates for UK All Companies sector funds is only positive in the single factor model, though not statistically significant while international Equity Growth sector funds outperform UK All Companies sector funds with consistent positive alphas across all factor models. It reverses in Equity Income sector as UK Equity Income sector funds show evidence of positive performance across all factor models, though insignificant while international Equity Income sector show consistent negative abnormal performance and in particular the negative alpha in the one factor model is statistically significant in the case of equally weighted portfolio at 10% significance level. The underperformance of international Equity Income sector holds for both equal-weighted and value-weighted portfolios, though mostly insignificant. Both UK Smaller Companies sector and international Mid&Small Companies sector reveal insignificant positive abnormal performance on a risk-adjusted basis. Equal-weighted portfolio of international Mid&Small Companies sector show significant outperformance at 10% level compared to UK Smaller Companies sector.

Table 5. 1: Equal-Weighted and Value-Weighted Portfolio Performance of UK Domestic and International Equity Mutual Funds Based on Alpha Estimates from Factor Models

				Equally-Weighted			Value-Weighted		
Factor Model	Sample	No. Funds	No. Obs	Alpha	Alpha SE	R^2	Alpha	Alpha SE	R^2
One Factor	UK Domestic Entire Sample	650	207	0.088%	0.0009	0.91	0.088%	0.0008	0.93
Model	UK All Companies	416	207	0.025%	0.0008	0.93	0.007%	0.0007	0.94
	UK Equity Income	143	207	0.085%	0.0008	0.91	0.166%*	0.0010	0.88
	UK Smaller Companies	91	207	0.350%	0.0023	0.60	0.324%	0.0023	0.60
	International Entire Sample	627	207	0.030%	0.0014	0.84	0.110%	0.0015	0.83
	Intl. Equity Growth	578	207	0.029%	0.0014	0.84	0.108%	0.0015	0.82
	Intl. Equity Income	35	207	-0.179%*	0.0010	0.90	-0.189%	0.0017	0.64
	Intl. Mid&Small Companies	14	207	0.214%	0.0015	0.82	0.281%	0.0021	0.53
Three Factor	UK Domestic Entire Sample	650	207	0.017%	0.0006	0.96	0.038%	0.0006	0.96
Model	UK All Companies	416	207	-0.029%	0.0006	0.97	-0.043%	0.0006	0.96
	UK Equity Income	143	207	0.036%	0.0007	0.93	0.136%	0.0009	0.89
	UK Smaller Companies	91	207	0.168%	0.0011	0.91	0.139%	0.0010	0.92
	International Entire Sample	627	207	0.095%	0.0014	0.86	0.172%	0.0015	0.84
	Intl. Equity Growth	578	207	0.095%	0.0014	0.85	0.171%	0.0015	0.83
	Intl. Equity Income	35	207	-0.127%	0.0009	0.91	-0.183%	0.0017	0.64
	Intl. Mid&Small Companies	14	207	0.261%*	0.0014	0.84	0.259%	0.0020	0.54
Four Factor	UK Domestic Entire Sample	650	207	-0.017%	0.0006	0.97	0.004%	0.0007	0.96
Model	UK All Companies	416	207	-0.057%	0.0006	0.97	-0.074%	0.0006	0.96
	UK Equity Income	143	207	0.02%	0.0008	0.93	0.121%	0.0010	0.89
	UK Smaller Companies	91	207	0.094%	0.0012	0.91	0.058%	0.0011	0.92
	International Entire Sample	627	207	0.134%	0.0013	0.86	0.204%	0.0015	0.84
	Intl. Equity Growth	578	207	0.135%	0.0013	0.86	0.204%	0.0015	0.84
	Intl. Equity Income	35	207	-0.131%	0.0009	0.91	-0.112%	0.0017	0.66
	Intl. Mid&Small Companies	14	207	0.321%**	0.0014	0.84	0.313%	0.0020	0.55

Table 5.1 shows the alphas of equal-weighted and value-weighted portfolios of all funds as well as funds in each sector estimated over the sample period from January 1998 to March 2015 for UK domestic and international equity mutual funds respectively. The dependent variable is the monthly excess returns net of fees and costs on equal-weighted and value-weighted portfolios. The factor models without market timing are estimated in equation (4.1). Alphas with corresponding standard errors are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

These results imply that on average active management does not earn superior abnormal return for UK domestic and international equity mutual funds. It provides some evidence of informational efficiency for UK domestic and international fund market, which is consistent with Blake and Timmermann (1998) and Blake et al. (2014) for UK unit trusts as well as Busse, Goyal and Wahal (2013) for US international retail equity mutual funds. In the Equity Income sector, domestic funds are able to deliver better performance compared to international funds, which means domestic funds that aim to provide retail investors with stable revenue income perform better during the sample period from January 1998 to March 2015. In contrast, international funds almost outperform domestic funds in the other two sectors that are more growth oriented. Although the developed market risk factors we use in measuring the performance of international funds suffer from the drawback of lack of strong explanatory power over the excess return of emerging market funds, we find consistent evidence of outperformance of the entire sample for international funds whether adjusting for risk exposure or not during our sample period 1998-2015.

Table 5.2 analyzes the performance of equal-weighted and value-weighted portfolios of UK domestic and international equity mutual funds and in particular the market timing ability of fund managers by utilizing alternative factor models. For the entire sample of domestic and international funds, there is little evidence of positive abnormal performance in terms of the total performance measure (TM) whether the portfolio is equal-weighted or value-weighted. Domestic funds show strong evidence of negative market timing effects across all factor models. Therefore, even though the alpha estimates are significantly positive in one-factor and three-factor models, the significant negative market-timing coefficients consistently lower the total performance measure for portfolios of all domestic funds. In contrast, the evidence of positive alpha and negative market timing effects are much weaker for the entire sample of international funds. The β_{mt} is negative in the case of equal-weighted portfolio and positive in the case of value-weighted portfolio but neither of them is statistically significant. Similar to our previous findings, the entire sample of international funds still slightly outperforms its domestic counterpart after accounting for market timing components across almost all factor models though neither alphas are significant. The only exception is again the equal-weighted portfolio measured by Jensen's alpha from the one factor model.

These findings imply that there is little evidence that fund managers in the UK are able to deliver superior performance through market timing strategy especially for those funds that

focus on domestic markets rather than diversify internationally. On average active management does not add value for both domestic and international retail fund investors from either stock picking or market timing. Our results regarding UK domestic equity mutual funds are consistent with Blake et al. (2014) that find little evidence of abnormal performance for UK domestic equity mutual funds. Since our evidence is based on average performance instead of analysis of performance distribution that focus on individual funds. Therefore, we could not conclude that individual funds that have stock picking skill and follow market-timing strategy cannot outperform the benchmark. We will provide more evidence regarding individual fund manager's skills in bootstrap simulation analysis.

In addition to studying the samples of international funds that include both developed and emerging market funds, we examine the performance of all developed market funds using factor models for robustness check. Table 5.3 displays the alpha estimates for developed market funds based on factor models. The results are similar to the findings with respect to international funds in Table 5.1 and Table 5.2. There is little evidence of positive abnormal performance for the entire sample of developed market funds based on alphas and total performance measures whether the portfolio we examine is equal-weighted or value-weighted. The only exception is Developed Market Mid&Small Companies sector funds, which show significant positive abnormal performance based on the alpha and the total performance measure across almost all factor models. Consistent with the findings on the whole international fund sample, there is little evidence of positive market timing in the performance of developed market funds. We also form international fund samples with different geographical region focus and find little evidence of positive abnormal performance across factor models as shown in Table 5.4. It is interesting that on a relative basis, emerging market funds perform better compared to developed market funds, which is consistent with Busse, Goyal and Wahal (2013). There is significant evidence of positive market timing effects for regionally focused developed market funds while emerging market funds exhibit negative but insignificant market timing coefficients across factor models.

Table 5. 2: Equal-Weighted and Value-Weighted Portfolio Performance of UK Domestic and International Equity Mutual Funds from Factor Models with Market Timing

				Equal-Weighted						Value-Weighted					
Factor Model	Sample	No. Funds	No. Obs	Alpha	Alpha SE	β_{mt}	β_m SE	TM	R^2	Alpha	Alpha SE	β_{mt}	β_m SE	TM	R^2
One Factor	Domestic	650	207	0.242%**	0.0010	-0.86*	0.51	0.093%	0.91	0.231%***	0.0009	-0.80**	0.38	0.093%	0.93
Model	International	627	207	0.066%	0.0016	-0.17	0.44	0.032%	0.84	0.066%	0.0017	0.21	0.48	0.108%	0.83
Three Factor	Domestic	650	207	0.122%*	0.0007	-0.58**	0.24	0.021%	0.97	0.148%**	0.0007	-0.61**	0.24	0.012%	0.96
Model	International	627	207	0.127%	0.0016	-0.16	0.37	0.096%	0.86	0.119%	0.0017	0.26	0.41	0.170%	0.84
Four Factor	Domestic	650	207	0.085%	0.0007	-0.55**	0.24	-0.010%	0.97	0.111%	0.0008	-0.57**	0.25	0.043%	0.96
Model	International	627	207	0.169%	0.0015	-0.17	0.37	0.136%	0.86	0.152%	0.0017	0.25	0.41	0.202%	0.84

Table 5.2 shows the total performance of equal-weighted and value-weighted portfolios of all funds estimated over the sample period from January 1998 to March 2015 for UK domestic and international equity mutual funds respectively. The dependent variable is the monthly excess returns net of fees on equal-weighted and value-weighted portfolios. The basic factor models are the same as Table 5.1. A quadratic term in the market excess return $\eta_i(R_{m,t} - R_{f,t})^2$ is added to each of the three factor models. The total performance measure is calculated as $TM = \alpha_i + \eta_i Var(R_{m,t} - R_{f,t})$. Alphas, η_i and total performance measures with corresponding standard errors are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 5. 3: Equal-Weighted and Value-Weighted Portfolio Performance of Developed Market Funds Based on Alpha Estimates from Factor Models

				Equal-Weighted						Value-Weighted					
Factor Model	Sample	No. Funds	No. Obs	Alpha	Alpha SE	β_m	β_{mt} SE	TM	R^2	Alpha	Alpha SE	β_m	β_{mt} SE	TM	R^2
One Factor Model	Entire Sample	459	207	0.009%	0.0011				0.88	0.053%	0.0013				0.86
	Equity Growth	413	207	0.007%	0.0011				0.88	0.052%	0.0013				0.86
	Equity Income	35	207	-0.179%*	0.0010				0.90	-0.189%	0.0017				0.64
	Mid&Small Companies	11	207	0.241%*	0.0014				0.84	0.283%	0.0021				0.53
Four Factor Model	Entire Sample	459	207	0.080%	0.0011				0.89	0.123%	0.0012				0.87
	Equity Growth	413	207	0.080%	0.0011				0.89	0.123%	0.0013				0.87
	Equity Income	35	207	-0.131%	0.0010				0.91	-0.112%	0.0017				0.66
	Mid&Small Companies	11	207	0.319%**	0.0013				0.86	0.314%	0.0021				0.55
Four Factor Model	Entire Sample	459	207	0.043%	0.0012	0.18	0.34	0.079%	0.89	0.032%	0.0014	0.44	0.38	0.120%	0.87
With Market Timing	Equity Growth	413	207	0.038%	0.0012	0.21	0.34	0.079%	0.89	0.028%	0.0014	0.46	0.38	0.120%	0.87
	Equity Income	35	207	-0.052	0.0012	-0.39	0.31	-0.128%	0.91	-0.088%	0.0026	-0.12	1.27	-0.111%	0.66
	Mid&Small Companies	11	207	0.452%***	0.0014	-0.65	0.45	0.324%***	0.86	0.206%	0.0023	0.53	1.38	0.311%	0.55

Table 5.3 displays the performance of equal-weighted and value-weighted portfolios of all funds as well as funds in each sector estimated over the sample period from January 1998 to March 2015 for developed market mutual funds. The dependent variable is the monthly excess returns net of fees on equal-weighted and value-weighted portfolios. The results are robust to all the factor models, which are estimated in equation (4.1). Alphas, η_i and total performance measures with corresponding standard errors are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 5. 4: Equal-Weighted and Value-Weighted Portfolio Performance of International Funds with Different Geographical Region Focus Based on Factor Models

					Equal-Weighted				Value-Weighted			
Factor Model	Objective	Region Focus	No. Funds	No. Obs	Alpha	β_m	TM	R^2	Alpha	β_m	TM	R^2
One Factor Model	International	APXJ	112	207	-0.063%			0.91	0.018%			0.92
		Emerging Market	168	207	0.207%			0.69	0.239%			0.68
	Developed	Globally Diversified	339	207	-0.065%			0.92	-0.066%			0.91
	Countries	Regionally Focused	120	207	0.195%			0.67	0.288%			0.65
Four Factor Model	International	APXJ	112	207	-0.143%			0.92	-0.064%			0.93
		Emerging Market	168	207	0.437%			0.72	0.447%			0.70
	Developed	Globally Diversified	339	207	-0.017%			0.93	-0.017%			0.91
	Countries	Regionally Focused	120	207	0.324%			0.69	0.398%*			0.66
Four Factor Model	International	APXJ	112	207	-0.175%	0.09	-0.143%	0.92	-0.097%	0.10	-0.063%	0.93
With Market		Emerging Market	168	207	0.695%**	-1.25	0.439%	0.72	0.670%**	-1.08	0.448%	0.70
Timing	Developed	Globally Diversified	339	207	0.069%	-0.42	-0.014%	0.93	0.054%	-0.35	-0.015%	0.91
	Countries	Regionally Focused	120	207	0.020%	1.48**	0.313%	0.70	0.039%	1.75**	0.385%	0.67

Table 5.4 shows the performance of equal-weighted and value-weighted portfolios of international funds with different geographical region focus over 1998.1-2015.3. APXJ refers to funds with main investments in Asia Pacific ex Japan area. Emerging Market refers to funds that mainly invest in emerging market. Globally Diversified refers to developed market funds that diversify investments globally while Regionally Focused are those international funds invest in a single foreign market. The dependent variable is the monthly excess returns net of fees on equal-weighted and value-weighted portfolios. The unconditional factor models employed are the same as Table 5.3. Alphas, η_i and total performance measures with corresponding standard errors are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

5.3.2 Fund Performance in Different Market Conditions

Table 5.5 examines the risk-adjusted performance of equal-weighted portfolios of UK domestic and international equity mutual funds under different market conditions using alternative factor models. Following Glode et al. (2012), three market conditions – up-markets, mid-markets and down-markets are defined in terms of whether the three-month average of market excess return for a month is higher than its historical 75th percentile, between its historical 75th percentile and 25th percentiles or below its historical 25th percentile. Market returns for identifying UK domestic market conditions are three-month average of FTSE ALL Shares returns, and the history of market returns is dated back to October 1980. Similarly, market returns for identifying global market conditions are three-month average of Fama-French global market factor returns and the history of these returns is dated back to June 1990. Then, we measure fund performance under each of the three market conditions. We mainly focus on the performance of domestic and international funds under different UK domestic market conditions, as it matters most to UK retail investors. The results in the left panel of Table 5.5 suggest that in up-markets, which is defined on the basis of FTSE ALL Shares return, equal-weighed portfolio of UK domestic funds show significant positive abnormal performance across factor models without market timing, which indicates superior stock picking skills of domestic fund managers in booming markets while there is no significant evidence of abnormal performance for international funds. In mid and down-markets, there is little evidence of significant abnormal performance for domestic and international funds across factor models. Although both domestic and international funds generate significant positive abnormal returns in terms of total performance measure in up-market, there is little evidence of significant positive market timing effects are observed, especially in recessions. In the right panel, we find little evidence of abnormal performance in the three global market conditions for both domestic and international unit trusts. These results are inconsistent with Kosowski et al. (2006) who defined market conditions using NBER business cycle dates and found significant negative risk-adjusted performance in expansions and positive abnormal performance in recession. We find evidence that neither UK domestic or international equity mutual funds perform when it matters most to UK retail investors. Our results are also partially consistent with Kacperczyk, Nieuwerburgh and Veldkamp (2014) that documents time-varying manager skill in mutual funds: stock picking skills are commonly detected in expansions while market timing skill presents mostly in

recessions. The finding that neither domestic nor international mutual funds generate abnormal returns in down-market in Table 5.5 is robust when we compare the fund performance of two subsamples: pre-2008 financial crisis (January 1998 to December 2007) and post 2008 financial crisis (January 2008 to March 2015) for both UK domestic and international funds as shown in Table 5.6. We find no evidence of significant abnormal performance for both UK domestic and international unit trusts in the post-2008 2008 financial crisis period[34] though international funds generate a significantly positive risk-adjusted return when Carhart four factor benchmark is utilized.

[34] Our finding that neither domestic nor international mutual funds generate abnormal returns in down-market is also robust when alternative methods of defining sub-periods are employed, for instance, the timeline for the 2008 financial crisis defined by Office for National Statistics (ONS). ONS clarifies that in the UK, the 2008 financial crisis starts from April 2008 and ends in June 2009. See Appendix Table 5.15 for detailed findings on fund performance.

Table 5. 5: Whether UK Domestic and International Funds Perform When It Matters Most to UK Retail Investors

			UK Domestic Market Conditions							Global Market Condition						
Factor Model	Sample	Sub period	No. Obs	Alpha	Alpha SE	β_{mt}	β_{mt} SE	TM	R^2	No. Obs	Alpha	Alpha SE	β_{mt}	β_{mt} SE	TM	R^2
One Factor	Domestic	Up	41	0.584%**	0.0022				0.87	54	0.823%	0.0021				0.86
Model		Mid	112	0.180%	0.0011				0.85	111	0.088%	0.0010				0.84
		Down	54	-0.252%	0.0023				0.92	42	-0.316%	0.0023				0.94
	International	Up	41	0.586%	0.0044				0.65	54	0.439%	0.0044				0.67
		Mid	112	-0.066%	0.0017				0.79	111	0.022%	0.0018				0.75
		Down	54	-0.0651%	0.0032				0.88	42	-0.173%	0.0037				0.89
Four Factor	Domestic	Up	41	0.324%*	0.0017				0.95	54	0.207%	0.0015				0.95
Model		Mid	112	0.034%	0.0007				0.95	111	0.056%	0.0006				0.93
		Down	54	-0.071%	0.0016				0.97	42	-0.188%	0.0016				0.98
	International	Up	41	0.527%	0.0045				0.68	54	0.119%	0.0040				0.74
		Mid	112	0.010%	0.0015				0.82	111	0.092%	0.0017				0.77
		Down	54	0.056%	0.0030				0.90	42	-0.078%	0.0035				0.90
Four Factor	Domestic	Up	41	0.328%*	0.0016	0.73	1.02	0.400%**	0.95	54	0.213%	0.0016	-0.13	0.56	0.200%	0.95
Model with		Mid	112	0.033%	0.0009	0.02	0.56	0.035%	0.95	111	0.141%	0.0009	-1.06	0.73	0.053%	0.94
Market Timing		Down	54	0.032%	0.0018	-0.50	0.51	-0.112%	0.97	42	-0.210%	0.0022	0.10	0.56	-0.180%	0.98
	International	Up	41	0.467%	0.0044	2.76	1.99	0.720%**	0.69	54	-0.009%	0.0041	2.27	1.76	0.220%	0.75
		Mid	112	0.035%	0.0019	-0.26	1.09	0.009%	0.82	111	0.081%	0.0018	0.10	0.73	0.091%	0.77
		Down	54	0.310%	0.0038	-0.75	0.49	0.026%	0.90	42	0.139%	0.0041	-0.78	0.63	-0.135%	0.91

Table 5.5 examines the risk-adjusted performance of equal-weighted portfolios of UK domestic and international equity mutual funds under different market conditions using alternative factor models. Three market conditions - Up, Mid and Down are defined in terms of whether the three-month average of market excess return for a month is higher than its historical 75th percentile, between its historical 75th percentile and 25th percentiles or below its historical 25th percentile. Market returns for identifying UK domestic market conditions are three-month average of FTSE ALL Shares returns, and the history of market returns is dated back to October 1980. Similarly, market returns for identifying global market conditions are three-month average of Fama-French global market factor returns and the history of these returns is dated back to June 1990. We then measure fund performance under each market condition. The dependent variable is the monthly excess returns net of fees on equal-weighted and value-weighted portfolios. The results are robust to all factor models estimated in equation (4.1). Alphas and total performance measures with corresponding standard errors are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 5. 6: Whether UK Domestic and International Mutual Funds Perform in Two Subperiods:

Pre-2008 (1998.1-2007.12) and Post-2008 (2008.1-2015.3)

Factor Model	Sample	Sub periods	No. Obs	Alpha	Alpha SE	β_{mt}	β_{mt} SE	TM	R^2
One Factor	Domestic	Pre-2008	120	0.088%	0.0012				0.90
Model		Post-2008	87	0.086%	0.0014				0.93
	International	Pre-2008	120	0.253%	0.0019				0.84
		Post-2008	87	-0.274%	0.0022				0.86
Four Factor	Domestic	Pre-2008	120	0.012%	0.0008				0.97
Model		Post-2008	87	-0.038%	0.0011				0.97
	International	Pre-2008	120	0.339%*	0.0018				0.86
		Post-2008	87	-0.247%	0.0017				0.91
Four Factor	Domestic	Pre-2008	120	0.084%	0.0009	-0.45	0.38	0.016%	0.97
Model with		Post-2008	87	0.102%	0.0014	-0.60**	0.29	-0.019%%	0.97
Market									
Timing	International	Pre-2008	120	0.345%	0.0022	-0.03	0.49	0.339%	0.85
		Post-2008	87	-0.307%	0.0022	0.30	0.59	-0.247%	0.91

Table 5.6 examines the risk-adjusted performance of equal-weighted portfolios of UK domestic and international equity mutual funds in different subperiods using alternative factor models. The two subperiods are: pre-2008 financial crisis, which is from January 1998 to December 2007 and post 2008 financial crisis, which is from January 2008 to March 2015. We measure fund performance in the two subperiods respectively. The dependent variable is the monthly excess returns net of fees on equal-weighted and value-weighted portfolios. The results are robust to all factor models estimated in equation (4.1). Alphas and total performance measures with corresponding standard errors are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

5.3.3 Fund Size and Fund Performance

In Table 5.1 and Table 5.2, it is worth noting that the alphas and the total performance measures for value-weighted portfolios of international funds are higher than those for equal-weighted portfolios of international funds in absolute values. This implies that larger funds tend to produce higher abnormal returns than smaller funds. In other words, fund size does not erode performance for international funds, but improve fund performance to some extent. Therefore, we further examine whether fund size erodes mutual fund performance for domestic and international funds respectively.

Table 5.7 analyzes the performance for quintiles based on the size of UK domestic and international equity mutual funds using factor models. Following Joseph Chen et al. (2004), we sort funds into quintile portfolios at the beginning of each month based on the rankings of fund size in the previous month and track the five portfolios for one month. Then we measure the performance of each of the five-quintile portfolios using the entire time series of portfolio returns. The results for UK domestic equity unit trusts indicate that fund size is inversely correlated to future abnormal returns. The alpha is significantly positive for the bottom funds with smallest sizes and gradually lowers as fund size increases across almost all factor models. This holds for both equal-weighted portfolio and value-weighted portfolio. Even after accounting for significant negative market timing effects, the Q1 portfolios outperform the Q5 portfolios and there is a decline in the total performance measures from Q1 to Q5. It confirms Blake et al. (2014), which documented an inverse relationship between fund size and UK unit trust performance under various regression models that account for time and fund effects. Our results with respect to UK domestic funds are consistent with Ferreira et al. (2012), which find negative impact of fund size on US and UK domestic fund performance, though this inverse relationship does not apply to other countries in the world. However, diseconomies of scale seem not apply to international funds. There is little evidence of negative relation between fund size and international fund performance across all factor models. It is interesting that international funds with smallest sizes tend to perform the worst while those intermediate quintiles deliver higher alphas compared to the top and bottom quintiles though all the alpha estimates are not statistically significant. Our results are consistent with most previous evidence that shows little impact of fund size on performance or even economies of scale for international fund performance (e.g. Fortin and Michelson, 2005; Fan and Addams,

2012; Busse, Goyal and Wahal, 2013), but contrast to Fletcher and Marshall (2005b) that documents a negative relationship between fund size and performance of international unit trusts.

Some possible explanations for the observed inverse relationship between fund size and domestic unit trust performance includes the organizational diseconomies of scale pointed by Stein (2002), liquidity constraints and limited domestic investment opportunities. Although large funds have a number of advantages over small funds such as more resources for investment research and analysis, stronger bargaining power over spreads, more investment opportunities and spreading fixed cost over a large asset pool, they face challenges with increase in fund size (Ferreira et al., 2013a). Fund managers have to find good investment opportunities continuously to maintain their good performance record and might suffer from diluted skill. As fund size increases, the large trading volume will have greater price impact and incur higher trading costs (the effect of liquidity constraints) (Joseph Chen et al., 2004). Small funds, on the other hand, are more active and good at processing soft information that requires fund managers to make their own judgments instead of depending solely on quantitative analysis (Joseph Chen et al., 2004). The decreasing returns to scale is mostly documented for domestic mutual funds, as there are limited domestic investment opportunities and more fierce competition between active fund managers. Therefore, most large funds scale up their investment positions rather than exploiting new profitable assets (Pollet and Wilson, 2008). Active international mutual funds, in contrast to domestic mutual funds, have more incentive to diversifying into new assets and exploiting market inefficiency, as one of the main investment objectives of international fund investors is to achieve global diversification. Large international mutual funds also attract more skillful fund managers who are able to deliver superior performance because of economies of scale (Fan and Addams, 2012). For robustness check, we also examine the performance for quintiles based on the size of developed market funds using factor models. As shown in Appendix Table 5.16, the results are similar to those shown in Table 5.7.

We further analyze the impact of fund size on future performance controlling for the effects of other fund characteristics including fund family size, expense and age on performance. We follow the regression specifications of Blake et al. (2014) who argue that the Fama-Macbeth method used by Joseph Chen et al. (2004) tend to generate downward biased standard error due to fund effects and advocate the utilization of fixed-effect panel regression with a time

dummy and standard errors clustered by fund. Following Blake et al. (2014), the regression model is specified as follows:

$$R_{i,t} - R_{f,t} = \alpha_i + x_t'B + z_t'\Phi + \mu_t + \varepsilon_{i,t} \quad (5.1)$$

where $(R_{i,t} - R_{f,t})$ is the excess net return on fund i at time t, α_i represents the average performance across all funds, μ_t is a time effect, which is measured by a monthly time dummy, x_t' represents a vector of risk factors including excess returns on a market benchmark $(R_{m,t} - R_{f,t})$, size effect SMB_t, value effect HML_t, and one-year momentum effect MOM_t, z_t' includes a series of fund characteristics including fund size $lnAUM_{i,t}$, which is measured by relative size defined as a fund's total asset under management relative to the average value of assets under management across all funds in a month t, fund family size $lnFAUM_{i,t}$, which is measured by the ratio of a fund family's asset under management to the average value of the assets under management across all fund families in a month t, expenses $FMC_{i,t}$, and Age $lnAGE_{i,t}$, which is measured by ln $(Age_{i,t} + 1)$.

The results in Table 5.8 suggests that after controlling other fund characteristics and allowing for time and fund effects, fund performance is negatively affected by lagged fund size for both UK domestic and international equity mutual funds. This finding for UK domestic equity unit trusts confirms our earlier findings and suggests that diseconomies of scale exists in UK domestic equity mutual funds. However, the negative relationship between lagged fund size and fund performance for international mutual funds is not consistent with results in Table 5.7 and most previous evidence that suggests fund size and future performance are not inverse correlated in international equity mutual funds (e.g. Droms and Walker, 2001; Fan and Addams, 2012), though confirms Fletcher and Marshall (2005b). A possible explanation can be the organizational diseconomies of scale and the increase in transaction costs for international capital flow that offset the benefit gained from global diversification.

These findings complicate the controversy on the impact of fund size on future fund performance. Recently, Pástor, Stambaugh and Taylor (2015) point out that neglect of endogeneity of fund size might lead to wrong statistical inference when estimating the effect of fund size on performance. Larger funds might be run by more skilled managers, who in turn may bring in better performance and further expand fund size. To address omitted variable bias and finite-sample bias in traditional regression-based methodology, Pástor, Stambaugh and Taylor (2015) employ the recursive demeaning approach to analyze the

relationship between fund size and expected returns and find strong evidence of industry-level decreasing returns to scale but insignificant diseconomies of scale based on the recursive demeaning approach.

Table 5. 7: Whether Fund Size Erodes Fund Performance for UK Domestic and International Equity Mutual Funds

				Equally Weighted						Value Weighted					
Factor Model	Sample	AUM Quins	No. Obs	Alpha	Alpha SE	β_{mt}	β_m SE	TM	R^2	Alpha	Alpha SE	β_{mt}	β_m SE	TM	R^2
One Factor	Domestic	Q1	207	0.186%*	0.0010				0.87	0.253%**	0.0010				0.88
Model		Q2	207	0.122%	0.0011				0.88	0.168%	0.0011				0.87
		Q3	207	0.067%	0.0010				0.89	0.116%	0.0010				0.89
		Q4	207	0.035%	0.0009				0.91	0.067%	0.0009				0.91
		Q5	207	0.031%	0.0007				0.94	0.083%	0.0008				0.93
	International	Q1	206	0.016%	0.0014				0.83	0.055%	0.0015				0.83
		Q2	206	0.049%	0.0014				0.84	0.135%	0.0015				0.83
		Q3	206	0.050%	0.0013				0.85	0.126%	0.0014				0.85
		Q4	206	0.0705%	0.0014				0.84	0.154%	0.0014				0.84
		Q5	206	0.0591%	0.0015				0.84	0.130%	0.0016				0.82
Four Factor	Domestic	Q1	207	0.0632%	0.0007				0.95	0. 127%*	0.0007				0.95
Model		Q2	207	0.068%	0.0006				0.96	0.045%	0.0007				0.96
		Q3	207	-0.052%	0.0006				0.96	-0.005%	0.0006				0.96
		Q4	207	-0.060%	0.0006				0.97	-0.028%	0.0006				0.97
		Q5	207	-0.054%	0.0007				0.96	0.009%	0.0007				0.95
	International	Q1	206	0.157%	0.0013				0.86	0.188%	0.0013				0.86
		Q2	206	0.144%	0.0013				0.85	0.236%*	0.0014				0.85
		Q3	206	0.146%	0.0013				0.87	0.225%*	0.0013				0.87
		Q4	206	0.178%	0.0014				0.86	0.263%*	0.0014				0.86
		Q5	206	0.147%	0.0014				0.85	0.224%	0.0015				0.83

Four Factor	Domestic	Q1	207	0.177%**	0.0008	-0.61**	0.29	0.072%*	0.95	0.230%***	0.0008	-0.56**	0.25	0.134%**	0.95
Model with		Q2	207	0.110%	0.0007	-0.55**	0.27	0.014%	0.96	0.128%*	0.0007	-0.45	0.28	0.051%	0.96
Market		Q3	207	0.065%	0.0007	-0.63**	0.26	-0.043%	0.96	0.102%	0.0007	-0.57**	0.26	0.003%	0.96
Timing		Q4	207	-0.000%	0.0007	-0.32	0.21	-0.056%	0.97	0.023%	0.0007	-0.27	0.20	-0.024%	0.97
		Q5	207	0.067%	0.0008	-0.64**	0.26	-0.045%	0.96	0.134%	0.0009	-0.67**	0.28	0.018%	0.95
	International	Q1	206	0.091%	0.0016	0.32	0.51	0.154%	0.86	0.098%	0.0016	0.44	0.51	0.185%	0.86
		Q2	206	0.231%	0.0016	-0.42	0.46	0.147%	0.85	0.271%*	0.0016	-0.17	0.43	0.237%*	0.85
		Q3	206	0.163%	0.0015	-0.080	0.36	0.147%	0.87	0.220%	0.0015	0.020	0.37	0.224%*	0.86
		Q4	206	0.209%	0.0016	-0.15	0.37	0.179%	0.86	0.269%*	0.0016	-0.025	0.38	0.264%*	0.86
		Q5	206	0.089%	0.0016	0.29	0.42	0.145%	0.85	0.151%	0.0017	0.36	0.44	0.222%	0.83

Table 5.7 analyzes the performance for quintiles based on the size of UK domestic and international equity mutual funds using factor models. We sort funds into quintile portfolios at the beginning of each month based on the rankings of fund size in the previous month (Q1 represents the bottom quintile while Q5 is the top quintile) and track the five portfolios for one month. Then we measure the performance of each of the five-quintile portfolios using the entire time series of portfolio returns against alternative factor models. The results are robust to all factor models estimated in equation (4.1). Alphas, η_i and total performance measures with corresponding standard errors are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 5. 8: Panel Regressions of Fund Performance on Lagged Fund Size Using Net Returns

	Domestic				International			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	Model1	Model2	Model3	Model4	Model1	Model2	Model3	Model4
$(Rm-Rf)_t$	0.924***	0.929***			0.992***	0.998***		
	(0.005)	(0.006)			(0.007)	(0.008)		
SMB_t	0.288***	0.291***			0.076***	0.057***		
	(0.012)	(0.013)			(0.009)	(0.010)		
HML_t	0.013*	0.007			-0.105***	-0.111***		
	(0.008)	(0.010)			(0.011)	(0.014)		
UMD_t	0.031***	0.031***			-0.023***	-0.017***		
	(0.003)	(0.003)			(0.004)	(0.005)		
$lnAUM_{t-1}$		-0.001***	-0.001***	-0.001***		-0.001***	-0.001***	-0.001***
		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
$lnFAUM_{t-1}$		-0.001**	-0.001**	-0.001**		0.000	0.000	-0.000
		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
FMC_{t-1}		-15.818***	-8.697**	-8.697**		-133.926***	-131.145***	1,468.779***
		(4.740)	(4.007)	(4.007)		(12.467)	(11.948)	(363.197)
$lnAge_t$		-0.000	-0.001*	-0.001*		-0.002***	-0.002***	-0.000
		(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.001)
Constant	-0.000***	0.016**	0.007	0.007	0.000***	0.251***	0.248***	-2.775***
	(0.000)	(0.008)	(0.007)	(0.007)	(0.000)	(0.023)	(0.022)	(0.686)
Time Effects	NO	NO	NO	YES	NO	NO	NO	YES
Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	84,006	66,284	66,284	66,284	77,963	57,918	57,918	57,918
R-squared	0.778	0.783	0.002	0.002	0.692	0.703	0.007	0.210

Table 5.8 displays the panel estimates of impact of fund size on fund performance based on net returns controlling for fund characteristics including fund family size, expense and age. Model 1 is the standard Carhart four-factor model. Model 2 is extended factor model including fund characteristics but without any time effects. Model 3 follows Joseph Chen et al. (2004) who estimated abnormal returns from Carhart four-factor model for each fund first, and then regress the abnormal returns on fund size and other fund characteristics variables. Model 4 extends model 3 by including time effects. The dependent variables in the panel regression are based on monthly net returns over 1998.1-2015.3. The constant represents α, the average skill across all fund managers. The time effects μ_t is included in Model 4 but not reported. The results are robust when we add extra control variables in Model 2, 3, and 4 for international mutual funds. Standard errors are clustered by fund. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

5.3.4 Bootstrap Simulations

The finding that the average fund fails to deliver superior performance does not mean that some individual funds do not outperform or that there is a lack of superior managerial skills for all fund managers. Actively managed funds, which are able to beat the market or outperform the average fund, are always more attractive to retail investors while those funds, which are unable to gain abnormal returns can fail in the business of attracting investment capital. However, it is hard to tell whether the superior or inferior performance is a true reflection of manager skills or merely due to luck. Therefore, we first examine the cross-sectional distribution of performance across individual funds for both domestic and international funds. Then, as we explained in section 5.1 and 5.2, we need to apply the bootstrap simulation procedures introduced by Fama and French (2010) across all individual funds to distinguish skill from luck.

Table 5. 9: Distribution of Individual Fund Performance

	Domestic Funds		International Funds		Developed Market Funds	
	Four-Factor Alpha	Five-Factor TM	Four-Factor Alpha	Five-Factor TM	Four-Factor Alpha	Five-Factor TM
Percentiles of Risk-Adjusted Performance						
Bottom	-24.27%	-24.18%	-22.20%	-26.11%	-11.79%	-11.79%
1	-7.19%	-7.19%	-10.93%	-11.68%	-8.86%	-9.19%
5	-4.70%	-4.58%	-6.63%	-7.08%	-5.61%	-5.50%
10	-3.43%	-3.19%	-4.81%	-4.70%	-4.24%	-4.24%
50	-0.48%	-0.36%	-0.60%	-0.60%	-0.96%	-0.96%
90	3.29%	3.29%	4.66%	4.53%	2.67%	2.67%
95	4.78%	4.91%	7.06%	7.19%	3.78%	3.91%
99	8.60%	9.25%	13.35%	13.22%	7.57%	7.83%
Top	16.77%	17.46%	29.08%	29.99%	29.08%	29.99%
Percentage of Positive Performance						
at 10% significance level	8.15	9.08	6.06	6.22	3.92	4.14
at 5% significance level	5.38	6	3.51	3.19	2.83	2.61
at 1% significance level	2.15	2.46	1.43	1.59	1.09	1.31
Percentage of Negative Performance						
at 10% significance level	12	11.23	12.12	13.08	15.25	15.47
at 5% significance level	7.85	7.85	8.29	8.29	10.46	10.02
at 1% significance level	2.77	2.92	3.35	3.35	4.58	4.36
Number of Funds	650		627		459	

Table 5.9 reports percentiles of alphas and the total performance measures from time-series regression of individual domestic, international and developed market funds on alternative factor models over the sample period of 1998 to 2008.

Table 5.9 reports chosen percentiles of annualized four-factor alphas and total performance measures from Carhart four-factor model with market timing effects, which are based on individual fund regressions for domestic, international and developed market funds. The percentage of positive and negative alphas, which are statistically significant at 10%, 5% and 1% significance level are also presented. For domestic funds, the median fund slightly underperforms with a negative annualized four-factor alpha of -0.48% and a negative annualized total performance measure (TM) of -0.36% during the sample period from January 1998 to March 2015, which means that after all associated costs have been deducted, retail investors are not better off from investing in the median fund. The 90th percentile of risk-adjusted performance is not high, though positive. Even after adding back an average of 2.25%, that is, AMC plus geometric annual average of initial load that amortized over five years, the 90th percentile only generates a risk-adjusted return of 5.54%. The 95th percentile of risk-adjusted performance only improves by 1.5% while the 99th percentile and top funds generate impressive abnormal performance net of all costs. It is worth noting that the bottom fund delivers very poor performance with an annualized four-factor alpha of -24.27%. We observe that only 5.38% of domestic funds produce positive and statistically significant four-factor alphas while 7.85% of domestic funds significantly underperform at 5% significant level. Moreover, at the 1% level of significance, the number of significantly outperformed funds is very close to the number of significantly underperformed funds.

Similar to the median domestic fund, the median international fund delivers negative risk-adjusted performance with an annualized four-factor alpha of -0.60%. This implies that international fund investors who put money into the median fund lose slightly more than their domestic counterparts. The 90th percentile of four-factor alpha is slightly higher than the 90th percentile of domestic fund performance, though still not large. After adding back an average of 2.3%, annual fee charge for international funds, the 90th percentile generates an abnormal return of 6.9%. From the 95th percentile on, international funds deliver much higher four-factor alphas compared to domestic funds. It is worth noting that although the bottom international fund performs as poorly as the worst performing domestic fund, the alpha generated by the top international fund is almost twice that of the best domestic fund performing fund. Although domestic fund managers potentially have greater knowledge of their local markets, it seems that the "star" international fund managers with a relatively larger investment universe might have access to better investment opportunities in foreign

markets especially emerging markets where the market is believed not as efficient as domestic markets and hence deliver better performance than their domestic counterpart. At the 5% significance level, only 3.51% of international funds produce positive and statistically significant four-factor alphas while the percentage of significantly underperformed international funds reaches 8.29%, which is more than doubled. Unlike domestic funds, at the 1% level of significance, the difference between the number of significantly outperformed and underperformed funds does not narrow.

The median developed market fund delivers an even lower four-factor alpha of -0.96% in comparison to the median international fund. We observe that developed market funds underperform both domestic and international funds at each percentile from 50^{th} to 99^{th} but slightly outperform international funds at each percentile from 5^{th} to 10^{th} with less negative alphas and TMs. This implies that the significant outperformance and underperformance of international funds might be due to the more extreme performance of emerging market funds. It is interesting that the best-performing international fund is a developed market fund while the worst performing international fund comes from the set of emerging market funds. At the 5% level of significance, only 2.83% of developed market funds deliver positive and statistically significant alphas, which is fewer compared to domestic and the entire sample of international funds. In contrast, there are more than 10% of developed market funds that significantly underperformed at 5% significance level. This difference in percentages of significant outperformed and underperformed developed market funds enlarges when we apply an even strict significance level of 1%.

In Table 5.1, 5.2 and 5.3, we observe that the equal-weighted portfolio of domestic funds generates the lowest and negative four-factor alpha while the four-factor alpha for the equal-weighted portfolio of international funds is the highest and positive, though insignificant. It is different from the distribution of alphas presented in Table 5.9. The tails of the alpha distributions in particular the right tail of the distribution that generates large risk-adjusted alphas worth further investigation.

Table 5. 10: Bootstrap Results for UK Domestic Unit Trusts

	Bottom	1%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	99%	Top
	Funds Ranked on the t-Statistics of Four-Factor Alphas														
Annualized Alpha	-2.45%	-2.09%	-3.99%	-6.54%	-1.53%	-1.89%	-0.98%	-0.54%	0.14%	1.19%	1.68%	7.10%	4.19%	2.61%	6.47%
t-Four-Factor Alpha	-5.735	-3.757	-2.749	-2.174	-1.447	-1.043	-0.650	-0.310	0.130	0.473	0.861	1.435	1.943	3.106	4.806
Parametric p-value	<0.01	<0.01	<0.01	0.017	0.075	0.149	0.259	0.378	0.448	0.318	0.195	0.076	0.027	<0.01	<0.01
Bootstrapped p-value	<0.01	<0.01	<0.01	0.019	0.081	0.147	0.235	0.395	0.407	0.323	0.201	0.113	0.037	<0.01	<0.001

Table 5.10 reports the bootstrap simulation results based on t-statistic of four-factor alpha for UK domestic unit trusts. It presents chosen percentile points of cross-sectional distribution of estimated t-statistics of alphas as well as corresponding standard p-values and bootstrapped p-values. Both actual and bootstrapped t-statistics are based on Newey-West heteroscedasticity and autocorrelation adjusted standard errors.

Figure 5. 1: Probability Density Functions (Left) and Cumulative Density Functions (Right) of the Actual and Simulated t-statistics of UK Domestic Unit Trust Alphas

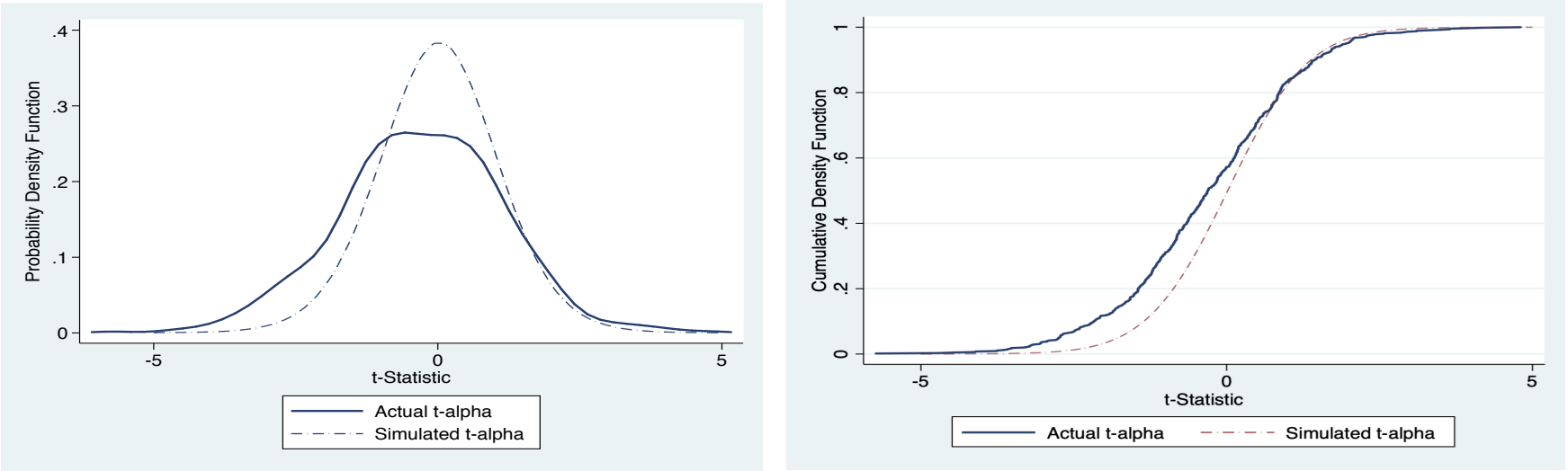


Figure 5.1 plots the kernel density estimates of the actual and bootstrapped distribution of t-statistics. The left figure shows the kernel density estimates of the probability density functions of the distribution while the right figure shows the kernel density estimates of the cumulative density functions of the distribution. The t-statistic estimates are based on Carhart four-factor model for all UK domestic funds.

Table 5.10 reports the bootstrap simulation results based on t-statistic of four-factor alpha for UK domestic unit trusts. Chosen percentile points of the cross-sectional distribution of t-statistics for estimated alphas as well as corresponding standard p-values and bootstrapped p-values are presented. The null hypothesis of zero true alpha, which assumes that all abnormal returns generated by fund managers are purely because of luck, is tested against the alternative hypothesis of non-zero true alpha, which implies that positive abnormal performance are generated from superior managerial ability while negative alphas represents evidence of poor stock-picking ability.

The top fund shows an actual ex-post t-statistic of 4.81 with a bootstrapped p-value less than 0.001. It indicates that less than 0.1% of the bootstrapped t-statistics from 10,000 bootstrap simulations across all funds are greater than the actual t-statistic of 4.81 under the null hypothesis of no outperformance. When we base statistical inference on a 5% upper tail cut off point, we can confidently reject that the top fund outperforms purely because of luck as the actual t-statistic line lies to the very right of the "luck distribution". We fail to find significant evidence of managerial skill for funds ranked lower than 95th percentile. At the other end of the t-statistic distribution, the bottom fund has an actual t-statistic of -5.74 with a bootstrapped p-value of 0.001, which means this fund truly delivers inferior performance. This significant underperformance cannot be entirely attributed to bad luck but rather the lack of management talent. The results confirm Kosowski et al. (2006), Cuthbertson, Nitzsche and O'Sullivan (2008) and Blake et al. (2014) with respect to the existence of a small group of skilled managers who have sufficient stock selection ability to deliver superior performance. However, Blake et al. (2014) applied 10,000 bootstrap simulations to both gross returns and net returns on 516 UK domestic unit trusts during the period from January 1998 to December 2008 and concluded that the skilled managers extract the abnormal performance via fees and do not benefit their shareholders from a comparison between bootstrap simulations based on gross returns and net returns. Our results are consistent with Cuthbertson, Nitzsche and O'Sullivan (2008). They based inference on net returns like us and found superior management talent among the best-performing fund managers. They also pointed out that most underperformed funds show evidence of bad skill rather than bad luck.

Figure 5.1 depicts the cross-sectional distribution of actual t-statistic estimates and the distribution of bootstrap simulated t-statistics that shows alphas achieved by chance alone ("luck distribution"). The left figure shows the kernel density estimates of the probability

density function of two distributions-the actual and bootstrapped t-statistics. We observe that the left tail of actual t-statistics distribution lies largely to the left of the distribution of bootstrap simulated t-statistics and the actual density also displays more probability mass in the right tail. The quite non-normal distribution of actual t-statistics with fat tails and less mass in the center cannot be fully explained by random chance or pure luck. Rather it confirms our prior evidence that in our sample, there exists a small number of fund managers with superior skill as well as a moderate number of fund managers without sufficient ability to deliver abnormal performance. The right figure, which plots the cumulative density functions, further approves our observations in the probability density functions. The cumulative density function of actual t-statistics lies to the left of the cumulative density function of bootstrapped t-statistics for most of the distribution of net returns. When funds are ranked above about 85th percentile, their actual t-statistics start to exceed the bootstrapped t-statistics, which confirms the results displayed in Table 5.10. Once again, it implies that a small number of fund managers are able to generate abnormal performance from stock selection that are sufficient to cover all associated costs.

Having analyzed the manager skill for all UK domestic unit trusts, we further investigate whether superior manager skill is concentrated in certain fund sectors. According to IMA classification, 413 funds out of 650 UK domestic unit trusts are identified as "UK All Companies" funds and 143 funds are "UK Equity Income" funds. The rest 91 funds are classified as "UK Smaller Companies" funds. We apply 10,000 bootstrap simulations to each fund sector and report the resulting actual t-statistics, annualized four-factor alphas and bootstrapped p-value of t-statistics of alphas for selected percentiles in Table 5.11. It shows that based on actual t-statistics of alpha, UK Equity Income funds that are ranked above 95th percentile and UK Smaller Companies funds that are ranked above 90th percentile achieve abnormal performance, which cannot be simply attributed to good luck. In particular, the 99th percentile UK Smaller Companies achieve a large positive annualized alpha of around 11.37% with an actual t-statistic of 3.93 and a bootstrapped p-value of <0.01, which strongly reject the null of zero true alpha. It provides evidence that in the right tail of performance distribution, some fund managers show superior stock-picking skill to generate significant positive alphas. However, there are hardly any UK All Companies funds that display stock-picking skill in the right tail of the distribution. We find that manager skill mainly concentrates among top performing UK Equity Income and Smaller Companies funds. Our

results are consistent with Cuthbertson, Nitzsche and O'Sullivan (2008) with respect to little evidence of skill existing in UK All companies fund managers and superior stock picking ability of UK Equity Income funds. Nevertheless, in contrast to Cuthbertson, Nitzsche and O'Sullivan (2008) who find little evidence of skill for small funds, we discover that UK Smaller Companies funds do have skill. At the left tail of distribution, the worst performing UK All Companies funds ranked lower than the 20th percentile show evidence of bad skill while UK Equity Income sector has a smaller number of unskilled managers. In contrast, the poor performance generated by UK Smaller Companies funds is largely due to bad luck rather than inferior skill. Once again, our findings are partially consistent with Cuthbertson, Nitzsche and O'Sullivan (2008) who documented bad skill for UK All Companies and Smaller Companies funds but bad luck for UK Equity Income funds. Since the main controversy lies on small funds, special attention should be paid to UK Smaller Companies funds in future research on UK unit trust performance and fund manager skill.

Table 5.12 reports the bootstrap simulation results based on t-statistics of four-factor alpha for the entire sample of international equity mutual funds. The results for international funds are quite similar to the findings on domestic funds shown in Table 5.10. The actual t-statistic of the top-performing fund is 3.84 with a bootstrapped p-value less than 0.001, which implies that less than 0.1% of the bootstrapped t-statistics are greater than the actual t-statistic of 3.84. Besides, the fund ranked at 99th percentile fund displays a large annualized alpha of 19.91% at 5% significance level based on bootstrapped p-value. Therefore, we can reject the null hypothesis that assumes the top fund outperforms merely due to luck based on a 5% cutoff. However, Funds ranked above the 60th percentile but lower than the 95th percentile are most likely to achieve outperformance by chance rather than superior skill as we fail to reject the null of no abnormal performance based on bootstrapped p-value of t-statistics. At the other tail of the t-statistic distribution, funds ranked below the 20th percentile, especially the worst performing 5% funds, truly deliver inferior performance based on bootstrapped p-value of t statistics. This significant poor performance can be well explained by truly inferior skill rather than random resampling error.

Table 5. 11: Bootstrap Results for UK Domestic Unit Trusts in Different Sectors

		Bottom	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	99%	Top
UK All Companies	t- Alpha	-5.74	-3.06	-2.51	-1.70	-1.22	-0.84	-0.53	-0.16	0.18	0.61	1.18	1.71	2.58	3.31
(416)	Ann. Alpha	-2.45%	-2.66%	-16.73%	-2.12%	-1.71%	-0.97%	-0.60%	-0.41%	0.41%	0.83%	1.58%	2.94%	4.59%	8.32%
(64%)	BS p-tstat	<0.01	<0.01	0.011	0.052	0.137	0.183	0.265	0.413	0.439	0.273	0.130	0.056	<0.01	0.177
UK Equity Income	t- Alpha	-3.05	-2.34	-1.69	-1.28	-0.87	-0.40	0.10	0.43	0.78	1.00	1.55	1.79	2.33	4.19
(143)	Ann. Alpha	-3.03%	-3.36%	-3.75%	-2.99%	-3.57%	-0.43%	0.16%	1.04%	0.98%	2.00%	2.09%	2.85%	5.26%	8.77%
(22%)	BS p-tstat	<0.01	0.012	0.058	0.104	0.171	0.362	0.456	0.375	0.216	0.199	0.081	0.050	0.020	<0.01
UK Smaller	t- Alpha	-2.68	-1.64	-1.28	-0.62	-0.32	0.18	0.39	0.63	0.92	1.39	1.94	2.30	3.93	4.81
Companies	Ann. Alpha	-4.71%	-5.81%	-3.65%	-2.04%	-0.45%	0.41%	0.66%	4.87%	2.63%	4.11%	4.19%	3.48%	11.37%	6.47%
(91)	BS p-tstat	<0.01	0.058	0.111	0.271	0.359	0.438	0.336	0.220	0.198	0.113	0.037	0.015	<0.01	<0.01
(14%)															

Table 5.11 reports the bootstrap simulation results based on t-statistic of four-factor alpha for UK domestic unit trusts in each IMA sectors. Chosen percentile points of cross-sectional distribution of estimated t-statistics of alphas as well as corresponding standard p-values and bootstrapped p-values are presented. Both actual and bootstrapped t-statistics are based on Newey-West heteroscedasticity and autocorrelation adjusted standard errors.

Table 5. 12: Bootstrap Results for UK-based International Equity Mutual Funds

	Bottom	1%	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	99%	Top
	Funds Ranked on the t-Statistics of Four-Factor Alphas														
Annualized Alpha	-4.09%	-6.71%	-3.23%	-4.92%	-3.16%	-1.35%	-1.10%	-0.42%	0.10%	5.54%	3.07%	4.42%	7.69%	19.91%	7.38%
t-Four-Factor Alpha	-4.213	-3.428	-2.715	-1.975	-1.383	-0.970	-0.620	-0.273	0.102	0.498	0.874	1.337	1.730	2.862	3.843
Parametric p-value	<0.01	<0.01	<0.01	0.025	0.090	0.167	0.268	0.393	0.459	0.311	0.192	0.092	0.043	<0.01	<0.01
Bootstrapped p-value	<0.01	<0.01	<0.01	0.028	0.079	0.176	0.258	0.384	0.436	0.418	0.181	0.087	0.045	<0.01	<0.001

Table 5.12 reports the bootstrap simulation results based on t-statistic of four-factor alpha for UK-based international equity mutual funds. It presents chosen percentile points of cross-sectional distribution of estimated t-statistics of alphas as well as corresponding standard p-values and bootstrapped p-values. Both actual and bootstrapped t-statistics are based on Newey-West heteroscedasticity and autocorrelation adjusted standard errors.

Figure 5. 2: Probability Density Functions (Left) and Cumulative Density Functions (Right) of the Actual and Simulated t-statistics of UK-based International Fund Alphas

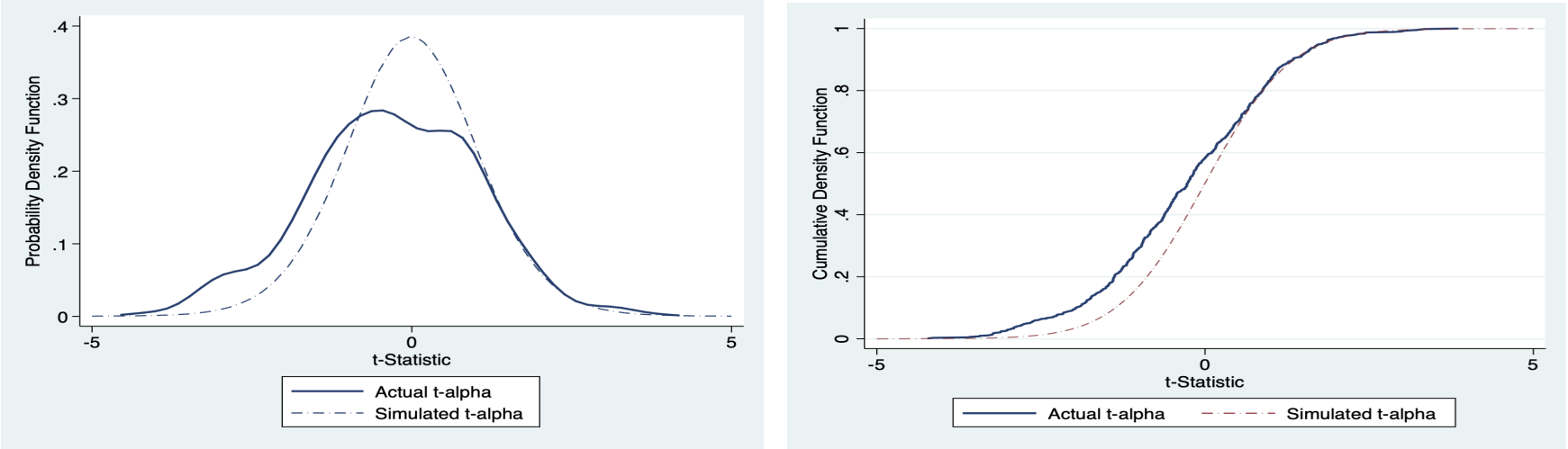


Figure 5.2 plots the kernel density estimates of the actual and bootstrapped distribution of t-statistics. The left figure shows the kernel density estimates of the probability density functions of the distribution while the right figure shows the kernel density estimates of the cumulative density functions of the distribution. The t-statistic estimates are based on Carhart four-factor model for all international funds.

Figure 5.2 plots the cross-sectional distribution of actual t-statistic estimates and the distribution of bootstrap simulated t-statistics for international funds. The left figure, the kernel density estimates of the probability density function, illustrates that actual t-statistics are not normally distributed and the density exhibits greater probability mass in both right and left tail. It is consistent with our prior evidence of a small group of skilled fund managers. Most fund managers in our sample are not capable of outperforming the benchmark while a significant number of fund managers show inferior manager ability. The right figure that plots the cumulative density functions illustrates that only when funds are ranked above about 95th percentile, their actual t-statistics start to exceed the bootstrapped t-statistics, which is consistent with the results displayed in Table 5.12. Compared to domestic funds, there are less skilled fund managers who are able to consistently generate good performance that covers all costs. Our results are consistent with Busse, Goyal and Wahal (2013) who found that a small number of US global fund managers possess stock-picking skill after applying 5,000 bootstrap simulations following the resampling procedure suggested by Fama and French (2010).

Table 5.13 presents the bootstrap simulation results for developed market funds and emerging market funds. We have 458 funds out of 627 international funds are defined as developed market funds, which mainly diversify their assets in developed markets and areas and 168 emerging market funds, which mainly invest in emerging markets and areas like China, Russia and Brazil. Following the approach initiated by Fama and French (2010) we apply 10,000 bootstrap simulations to each fund in the two categories and report the resulting actual t-statistics, annualized four-factor alphas and bootstrapped p-value of t-statistics for selected percentiles in Table 5.12. For developed market funds that produce positive abnormal performance, we can reject the null hypothesis that the actual t-statistic of 3.84 for the top fund can be purely attributed to luck. It also applies to 99th percentile as we can reject the null hypothesis of no abnormal returns net of all costs based on a 5% cut off points as only 1.4% of bootstrapped t-statistics are greater than 2.44. Therefore, in the right tail of performance distribution, a relatively small number of developed market fund managers have sufficient ability to generate superior alphas. Emerging market funds have more skilled fund managers based on the proportion of simulated t-statistics greater than the actual. For example, at 95th percentile, only 2.7% of simulated t-statistics are greater than the actual t-statistic of 1.85. Therefore, in contrast to Busse, Goyal and Wahal (2013), we find evidence of skill for

developed market funds and emerging market funds in our UK sample especially the emerging market fund managers who can generate large alphas from selecting stocks. At the left tail of distribution, the worst performing developed market funds show evidence of inferior skill while there is only a very small number of emerging market fund managers have bad skill.

Table 5. 13: Bootstrap Results for Developed Market Funds and Emerging Market Funds

		Bottom	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	99%	Top
Developed Market Funds	t- Alpha	-4.21	-2.91	-2.30	-1.58	-1.19	-0.84	-0.53	-0.23	0.16	0.68	1.13	1.63	2.44	3.84
(458)	Ann. Alpha	-4.09%	-3.19%	-3.86%	-1.56%	-1.25%	-2.74%	-0.87%	-0.66%	0.36%	1.31%	3.14%	3.88%	4.86%	7.38%
(73%)	BS p-tstat	<0.01	<0.01	0.013	0.059	0.152	0.239	0.294	0.439	0.453	0.267	0.134	0.058	0.014	<0.01
Emerging Market Funds	t- Alpha	-2.12	-1.45	-1.15	-0.72	-0.23	0.18	0.42	0.64	0.89	1.10	1.61	1.85	3.00	3.34
(168)	Ann. Alpha	-11.47%	-5.49%	-8.68%	-2.48%	-1.85%	0.76%	2.21%	3.22%	6.59%	5.75%	6.96%	12.69%	24.05%	19.62%
(27%)	BS p-tstat	0.030	0.084	0.132	0.227	0.428	0.438	0.337	0.268	0.202	0.370	0.063	0.027	0.468	<0.01

Table 5.13 reports the bootstrap simulation results based on t-statistic of four-factor alpha for Developed Market Funds and Emerging Market Funds. Chosen percentile points of cross-sectional distribution of estimated t-statistics of alphas as well as corresponding standard p-values and bootstrapped p-values are presented. Both actual and bootstrapped t-statistics are based on Newey-West heteroscedasticity and autocorrelation adjusted standard errors.

5.4 Conclusion

In this chapter, we test the performance of 650 UK domestic equity unit trusts and 627 UK-based international equity unit trusts over the sample period from January 1998 to March 2015. The hypotheses tested and main findings are summarized in Table 5.14.

The empirical evidence suggests that on average, neither UK domestic or international funds deliver superior abnormal performance. The results are robust for alternative factor models used and hold whether the portfolio is equal-weighted or value-weighted. Therefore, the average fund manager shows little evidence of stock picking skill. The results from factor models with market timing effect show significant evidence of inferior market timing ability among UK domestic fund managers while there is little evidence of negative market timing ability among international fund managers. Nevertheless, we fail to document outperformance of domestic and international mutual funds in terms of the total performance measure, which captures stock selecting and market timing ability simultaneously. Our results regarding performance and market timing ability of UK domestic equity mutual fund managers are consistent with Cuthbertson, Nitzsche and O'Sullivan (2010a) and Blake et al. (2014) while the findings for UK-based international mutual funds are similar to Busse, Goyal and Wahal (2013) who found no evidence of outperformance for US-based international equity mutual funds. All these results suggest that the UK equity market is informationally efficient and diversifying investments internationally does not seem to add value.

Our second finding is that both UK domestic unit trusts and UK-based international equity unit trusts fail to deliver abnormal performance in bear market. Although there is some evidence that UK domestic mutual funds are able to outperform in bull market, neither domestic nor international funds perform when it matters most to retail investors, which is in recessions and post the 2008 financial crisis. Our results based on UK fund industry are not consistent with Kosowski et al. (2006) who examined the performance of US equity mutual funds in bull and bear markets and concluded that active management adds value in recessions.

We also examine the impact of fund size on mutual fund performance. Following the approach employed by Joseph Chen et al. (2004), we find that there is evidence of decreasing returns to scale in UK domestic unit trusts. However, it does not apply to international equity

mutual funds. We attributed the difference in the impact of fund size on performance between UK domestic and international funds to the organizational diseconomies of scale, liquidity constraints and limited domestic investment opportunities for UK domestic funds. However, when we further run panel regressions to investigate the effect of fund size on future performance controlling for other fund characteristics including fund family size, expense and age and allowing for time and fund effects, the result for UK-based international equity mutual funds is inconsistent with our previous evidence of no relationship between lagged fund size and fund performance. We find that lagged fund size negatively predicts future fund performance.

The last but not least, we find that there exist a small group of skilled domestic and international fund managers who are able to generate abnormal returns to retail investors, though the vast majority of fund managers show no evidence of superior manager. In contrast to Blake et al. (2014) who found that the abnormal returns generated was extracted by fund managers via management fees, we document that retail investors benefit from the small group fund managers' skill and are able to enjoy positive abnormal returns after deducting management fees, though the number of such fund managers can be very small. This finding does not necessarily suggest that the mutual fund market is inefficient. In a competitive market, we can expect that only a few outperformers can achieve superior performance over long horizons as long as the long run average abnormal return for most funds is zero. The international evidence on whether active management adds value is inconsistent with Busse, Goyal and Wahal (2013) who found no evidence of stock picking ability among developed market and emerging market fund managers. Our results show that a small number of developed and emerging market fund managers do possess superior management ability.

Our findings have several implications. Since both actively managed UK domestic and international funds show no evidence of superior performance and active funds in general charge higher fees than passive funds, retail investors might be worse off investing in actively managed mutual funds especially in recessions. The evidence might also suggest that many retail investors might not be able to evaluate investment performance correctly or find it costly to switch between funds. The results reveal poor market timing skills of UK domestic and international unit trusts/OEICs, which would fail to convince individual investors to pay for active management. Besides, investors should be cautious when investing in funds adopting market timing strategies.

Our study shed light on distinguishing skilled fund managers from those fund managers who achieve abnormal returns purely by luck. It seems that in the UK, skilled domestic funds tend to be in income and small cap styles rather than growth style while skilled international funds are mostly found to be emerging market funds. However, although there exist skilled fund managers who have sufficient ability to add value, the number of such fund managers can be too small for investors to identify. For the average individual investors, picking skilled managers can be very difficult and requires research on fund performance and sophisticated filtering procedures (Cuthbertson, Nitzsche and O'Sullivan, 2010b).

Our finding that diseconomies of scale exists in UK domestic and international funds have great implication to the empirical test of Berk and Green (2004)'s prediction that decreasing returns to scale from fund flows are the equilibrating mechanism, which lead to no performance persistence in UK domestic and international equity mutual funds.

The lack of managerial skill among actively managed domestic and international equity mutual funds would cast doubt on whether active fund managers should charge higher fees than passive fund managers. From the fund manager point of view, our results suggest that they should focus on stock picking rather than market timing. From a policymaker's perspective, the evidence on no abnormal returns generated by active management might suggest that the large fund flows into actively managed equity funds can be a misallocation of resources. Regulators like Financial Service Authority could offer retail investors some guidance for investing in actively managed funds and continue to supervise mutual funds and fund managers.

Table 5. 14: Summary of Hypotheses Tested and Main Results

Hypotheses Tested	Results
H1: Domestic and international funds do not generate significant outperformance above a benchmark.	There is evidence of overall informational efficiency of domestic and international funds.
H2: There is no significant difference in performance between UK domestic and international funds.	There is no difference in performance between domestic and international funds. The only exception is that international growth funds outperform domestic funds.
H3: UK domestic and international funds outperform the market in recessions and after the 2008 Global Financial Crisis.	Significant stock picking but not market timing skills are evidenced for domestic funds while no superior performance is found for international funds in up markets. No outperformance has been observed in mid- or down- markets for both types of funds.
H4: For UK domestic funds, performance declines with fund size while for international funds, performance does not decline with fund size.	Fund performance is negatively affected by lagged fund size for both domestic and international funds.
H5: For UK domestic and international funds, managerial skill exists among a small group of active fund managers.	A small number of fund managers are able to generate abnormal performance from stock selection that are sufficient to cover associated costs for UK domestic and international funds.

Chapter 6 Flow-Performance Relationship

6.1 Introduction and Hypotheses

Given that mutual fund management fees typically depend on a percentage of total assets under management, mutual fund managers are incentivised to attract investment inflows. Inflows typically follow superior performance, suggesting that investors expect positive abnormal returns can persist into the subsequent periods while outflows normally follow inferior performance and are viewed a sign of future underperformance. The relationship between fund flows and performance are of interest to both scholars and practitioners and are especially relevant in recessions when actively managed mutual funds may be expected to outperform their passive competitors and investor perception fluctuates significantly, which might lead to untypical investing behaviour. Hoffmann, Post and Pennings (2013) investigate investor behaviour during the 2008-2009 financial crisis and find that although individual investor's return expectation and risk tolerance temporarily decrease during the crisis, they keep trading and do not make efforts to reduce risk by switching into less riskier assets. Investors even attempt to enter stock market when stock prices are heavily depressed.

Ferreira et al. (2012) examined the performance of active equity mutual funds in 27 countries and provided international evidence of underperformance in fund industry. We also have shown in Chapter 5 that on average domestic actively managed mutual funds fail to generate abnormal returns after fees and expenses deducted, which is consistent with most existing literature. These findings suggest that the average active fund managers are unable to consistently deliver superior performance and questions whether active management truly adds value. If it doesn't, then we have to ask why investments continue to be made into actively managed mutual funds while there is overall underperformance in this industry. Gruber (1996) offered an explanation to this phenomenon. He argued that since manager skill is not included in the price of open-end mutual funds, it can be predicted. Investors who are smart enough can identify fund managers with superior management skill and probably earn abnormal returns if they invest with those skilled fund managers. Besides, investors expect to benefit from active management when performance matters most to them, that is, in recessions. In a bear market, passive strategy performs as bad as the market while active

strategy, as suggested in recent literature (e.g. Kosowski, 2011), can generate positive abnormal returns. The aggregate underperformance of active fund managers is largely due to the underperformance of active funds during expansion periods and does not imply that there is no manager skill at individual fund level (Kosowski, 2011; Busse, Goyal and Wahal, 2013). These findings encourage investors who want to gain abnormal returns and prevent loss in recessions to direct their money into active mutual funds in a bear market.

One of the primary objectives for our research is to investigate the behavior of mutual fund investors in particular those retail investors of actively managed domestic and international mutual funds. We choose to study the flow-performance relationship to better understand the behavior of individual investors that trade fund shares in the market. This study not only contributes to the existing literature on the flow-performance relationship, investor behavior and Berk and Green (2004) equilibrating mechanism of fund flows, but also has significant practical implications for both fund managers and investors. In practice, a primary objective of mutual fund management is to attract new investments. Gaining knowledge on flow-performance relationship and the factors that influence this relationship and investors' decision-making will allow fund managers to accurately predict investors' behaviour and develop strategies to increase cash inflows and avoid cash outflows. For investors, especially individual investors with limited time, knowledge and access to information on the fund industry, learning patterns of investor behaviour as well as understanding how performance responds to fund inflows and outflows can help retail investors overcome irrationality and make better investment decisions.

The flow-performance relationship described above could be viewed as a two-step process. Step one is the impact of past performance on subsequent fund flows, and step two is the influence of fund flows on future performance. Berk and Green (2004) model the two-step process as: investors chase past performance and the large inflows to past winners will deteriorate their performance due to decreasing return to scale from fund flows. To test Berk and Green (2004) model, we will examine the two relationships separately. In this chapter, we will focus on the reaction of fund flows to past performance and leave the impact of fund flows to subsequent performance to chapter 7. Therefore, for the remainder of this chapter, the flow-performance relationship specifically refers to the relationship between fund flows and past performance.

The positive relationship between past performance and subsequent fund flows has been widely observed in empirical studies (e.g. Ippolito, 1992; Sirri and Tufano, 1998; Del Guercio and Tkac, 2002; Barber, Odean and Zheng, 2005; Berk and Tonks, 2007; Jennifer Huang, Wei and Yan, 2007; Goriaev, Nijman and Werker, 2008; Keswani and Stolin, 2008; Ferreira et al., 2012; Keswani and Stolin, 2012). Among the earliest studies carried on flow-performance relationship, Sirri and Tufano (1998) found that investment decisions were based on past performance and funds asymmetrically flowed into well performing mutual funds but fail to flow out of poorly performing funds. Investors in general preferred small and less risky funds with lower fee charges. However, higher advertising expenses reduced the investor's searching cost for well performing funds. Hence, fund inflows seem to be more sensitive to outperformance when higher marketing efforts were exerted to lower investor's search cost. The convexity in the flow-performance relationship was confirmed by most subsequent studies (e.g. Del Guercio and Tkac, 2002; Lynch and Musto, 2003; Elton, Gruber and Busse, 2004; Barber, Odean and Zheng, 2005; Bollen, 2007; Jennifer Huang, Wei and Yan, 2007). These studies investigated the determinants of future fund flows as well as factors that impact on the sensitivity of fund flows to past performance. Del Guercio and Tkac (2002) attributed the observed difference in flow-performance relationship between mutual funds and pension funds to different client characteristics in the two fund segments. They found that flow-performance relationship was more convex for mutual funds than for pension funds as mutual fund investors were more reluctant to punish the worst performing funds by withdrawing money out of them. Goriaev, Nijman and Werker (2008) studied flow-performance relationship from the perspective of performance dissemination in the mutual fund industry. They discovered that investors were more sensitive to information disseminated over the previous six months rather than the most recent performance information. However, they found this pattern was particularly relevant in the 1990s, but this pattern gradually disappeared after 2000 as investors relied more on very recent information to make investment decisions. Jennifer Huang, Wei and Yan (2007) showed that the slope of flow-performance relationship was determined by participation costs measured by expense ratios, load fees, and fund family. High participation cost results in more sensitive flow-performance relationship for funds in the high performance range but leads to less sensitive fund flows to past performance for funds in the median performance range. While most empirical mutual fund studies have been carried out on US domestic funds, Keswani and Stolin (2012) studied

the determinants of inflows and outflows separately for UK institutional and retail mutual fund investors. Their results suggested that the flow-performance relationship was more convex for retail investors using independent advisors than tied agent and private advisors and the convexity was mainly driven by the extreme inflows to past outperformance. Ferreira et al. (2012) tested the flow-performance relationship around the world by conducting a cross-country study on 28 countries. They found that there were significant differences in the flow-performance relationship across countries and the empirical evidence on US mutual funds could not be generalized to other countries. In more developed countries, for instance, US and the UK, the flow-performance relationship was approximately linear since investors appeared to be more sophisticated and participation costs were much lower in these countries. There are few studies that pay attention to the determinants of fund flows to international equity mutual funds. In addition to establishing flow-performance relationship, Zhao (2008) also examined the impact of variables including risk, expense, turnover ratio, number of investment objectives offered by fund family, change in exchange rates, correlation with domestic markets and regional diversification on future fund flows to US-based international equity mutual funds. Zhao (2008) suggested that international fund investors show return-chasing behavior but paid more attention to risk-adjusted return than raw returns as international fund investors are better educated and more sophisticated. However, unlike domestic fund investors, international fund investors seemed unconcerned about fund expenses. International equity funds, which are not highly correlated with US markets, less regionally focused and from fund families with more choice of investment objectives receive higher inflows (Zhao, 2008). It is worth noting that change in exchange rate did not have significant effect on future fund flows (Zhao, 2008). Adams and Hartsfield (2010), in contrast, reported a significantly negative relationship between fund flows and recent one-year fund performance. This negative relationship reverses when performance was measured over longer term (3 years). Patro (2010) conducted a comprehensive analysis of US-based international mutual funds and documented a strong flow-performance relationship. He found that the sensitivity of fund flows to past performance was higher when the correlation between fund returns and the returns of US market was low as international fund investors pursued global diversification. Busse, Goyal and Wahal (2013) studied US-registered international equity mutual funds and found that despite of absence of abnormal returns for international equity mutual funds, similar to domestic fund investors, international fund investors chased past performance. The

widely documented convex flow-performance relationship also applies to US retail international equity mutual funds.

In this chapter, we will also investigate the impact of two fund characteristics: total expense and fund family size on the sensitivity of flow-performance relationship for UK domestic and international equity mutual funds. In addition to past performance, individual investors can easily access to information on the above two characteristics, which are identified as valid measures of investor's search and participation costs (e.g. Sirri and Tufano, 1998; Jennifer Huang, Wei and Yan, 2007) and believed to have a significant effect on individual investor behavior in addition to client types or investor characteristics. Explanations for the difference in the flow-performance relationship between UK domestic and international mutual funds, which are based on information asymmetry, rational expectation and Berk and Green (2004) perspectives, will be provided. This chapter will be structured as follows. Firstly, we will conduct basic analysis on flow-performance relationship in UK domestic and international mutual funds focusing on three questions: 1) what type of returns matters: raw or risk-adjusted; 2) how do investors react to distributed lag of past performance and; 3) does beating a market benchmark matter? Secondly, we will examine the convexity in the flow-performance relationship using the piecewise linear regression approach employed by Sirri and Tufano (1998). Finally, we will analyze the impact of fund characteristics related to search costs on flow-performance sensitivity. We will pay more attention to the results for international funds and the comparisons between international and domestic funds as we expect that the flow-performance relationship of UK domestic equity unit trusts would be consistent with most existing evidence and the evidence for international funds deserves more attention especially when the literature on the determinants of fund flows into international funds is limited. We also develop special interest in observing potential changes in flow-performance relationship during 2008 financial crisis, which is believed to be an important channel to study investor behavior during the recent financial crisis. There are eight hypotheses that will be tested in this chapter.

Hypothesis 6: *Risk-adjusted past returns have a greater impact on fund flows into both UK domestic and international equity mutual funds than raw returns.*

Hypothesis 7: *Fund flows into UK-based international mutual funds are more sensitive to risk-adjusted returns than fund flows into UK domestic mutual funds.*

Hypothesis 8: *The sensitivity of fund flows to risk-adjusted returns is relatively stable around the 2008 financial crisis for international mutual funds but not for domestic mutual funds.*

The return chasing behavior has been well documented for domestic mutual funds (e.g. Gruber, 1996; Sirri and Tufano, 1998; Jennifer Huang, Wei and Yan, 2007) and investment behavior is considered to be greatly affected by investor characteristics (Del Guercio and Tkac, 2002). Previous evidence suggests that on average, international fund investors are characterized as wealthier, with higher education level and more sophisticated compared to domestic fund investors (e.g. Investment Company Institute, 1996; Zhao, 2008). International investment, however, is subject to extra uncertainty including barriers to investments, currency and political risks. Kaushik (2012) who studied the fund flows to emerging market equity funds pointed out that emerging markets are riskier in nature than developed markets. International fund investors are quite aware of the risk involved in global investing and willing to take the risk with the expectation to earn higher abnormal returns at the given level of risk. Thus, we anticipate that international fund investors who are characterized as more sophisticated than domestic fund investors and are aware of the extra risk and uncertainty associated with their internationally diversified portfolios, have more incentive to use performance measures incorporated with risk adjustments. Domestic fund investors, in contrast, have informational advantage over local markets. They may not use risk-adjusted performance measures directly, but do so unconsciously or indirectly. For instance, the Morningstar star ratings and some other fund advertisements are based on fund rankings on both risk and returns (Del Guercio and Tkac, 2002). Although both international and domestic fund are responsive to risk-adjusted returns, international investors are more sensitive to risk-adjusted performance measures. It is also worth testing whether the sensitivity of fund flows to risk-adjusted returns changes over time. We construct two subsamples: 1998-2007 and 2008-2015 to study changes in flow-performance relationship for UK domestic and international mutual funds. The survey and lab experiment conducted by Guiso, Sapienza and Zingales (2018) provided evidence of substantial increase in domestic investor's risk aversion

after the 2008 financial crisis whether quantitative or qualitative measures are employed[35]. They also pointed out that it appears that this change in investor's risk tolerance does not affected by "standard" factors such as wealth and consumption habits but triggered by the scary experience. The flow-performance relationship based on risk-adjusted returns is expected to be stable over the whole sample period for international funds, as international fund investors in general already gained a better understanding of portfolio diversification and risk incurred in fund investment before 2008. Besides, the much higher transaction costs involved in foreign investing can result in lower turnover rates on the overseas investments (Stulz, 1999). In contrast, domestic fund investors' risk aversion would increase significantly after the 2008 financial crisis especially when some domestic fund investors are ignorant about diversification and risk involved in fund investment before 2008. They are more likely to rebalance their portfolio to avoid incur higher risk especially when the transaction costs of domestic fund investors are much lower than that of international fund investors. However, less sophisticated domestic investors would gradually learn from the scary experience and incorporate risk adjustment more into measuring performance after the 2008 financial crisis.

Hypothesis 9: *For UK-based international mutual funds, fund flows are most sensitive to recent risk-adjusted performance while for UK domestic mutual funds, fund flows have a delayed response to past performance.*

Hypothesis 10*: For both UK-based international and UK domestic mutual funds, the discrete event of beating a market benchmark attracts fund inflows.*

In a mostly efficient market, rational investors should base their beliefs of expected returns on the most recent performance or update the performance information in a timely manner as all publicly available information will be fully incorporated and reflected in the current price. The difference in flow-performance sensitivity pattern between international and domestic equity mutual funds might be attributed to information asymmetry between domestic and

[35] According to Guiso, Sapienza and Zingales (2018), there are mainly two methods to measure individual risk aversion. It can be inferred from an individual's share of investments in risky asset or directly derived from the choices made by the individual in experiments or survey questions. The first method, which is also called revealed preferences, though easy to apply, suffers from several shortcomings including strong assumptions that all investors use the same historical distribution of returns and portfolio shares are instantaneously adjusted. Therefore, designed survey and lab experiments are more widely applied by researchers to overcome these problems and infer individual attitudes towards risk. In this thesis, we attempt to explain our findings by incorporating the concept of time varying risk aversion and using the existing findings on individual risk aversion. However, due to the research design and limited data access, we are unable to formally test individual risk aversion in this research. It worth an in-depth investigation in future research.

foreign investors in addition to the different investor characteristics. Brennan and Cao (1997) develop a dynamic model of international investment flows under the assumption of information asymmetry between domestic and foreign investors. In their model that abstracts from barriers to investment and currency risk, domestic investors have information advantages over foreign investors in a market. After a public signal being released, less well informed foreign investors revise their expectation about returns more than the better-informed domestic investors. If the news is good, foreign investors will buy more equities from domestic investors and drive up the prices. Although domestic investors respond to public signals with a lag, their information advantage is obtained from the gradual process of acquisition of superior information about signal realization. Therefore, international fund investors are more sensitive to most recent performance information as they are relatively less well-informed though sophisticated. Domestic fund investors, in contrast, respond to public signals with a lag. Even though the theory of rational expectation and efficient market hypothesis suggest that decision making should be independent of past information and prior beliefs and information set, they might take performance information disseminated several months ago into consideration to make investment decisions as they revise their expectations about returns dependent on the gradual signal realization through a learning process. If we further take the barriers to investment and currency risk that prevents international investors from trading on the recent released signal in a timely manner into consideration, this signal realization process can take much longer time.

Del Guercio and Tkac (2002) examine the importance of simply beating a market benchmark in attracting fund flows for pension funds and mutual funds and point out that the discrete event of beating a market is important in determining fund flows in the pension fund segment of the market as pension fund trustees view beating a market benchmark as a validation of manager skill and an easier way to justify the decision of hiring fund managers. We aim to investigate whether fund flows are affected by the discrete event of beating a market for UK-based international and domestic mutual funds. International investors are in general exposed to extra uncertainty including political risk and currency fluctuations from investing overseas. Domestic fund investors, on the other hand, who have informational advantages of the local market, are more clear about the domestic naïve benchmarks. Despite of the difference in investor characteristics, from rational expectation and Berk and Green (2004) perspectives, if both types of investors rationally interpret fund performance as evidence of manager ability,

the discrete event of beating a benchmark might be viewed as validation of manager skill and a signal of good investment opportunity.

Hypothesis 11: *For both UK domestic and international equity mutual funds, the response of fund flows convex relationship to past performance, with investors investing disproportionately more into top past performers but are reluctant to withdraw money from worst past preforming funds.*

Hypothesis 12: *The flow-performance relationship is more convex for the best past performing UK domestic mutual funds than the best past performing international equity mutual funds.*

Investors chase past performance as past performance is a most commonly used measure for manager skill (Berk and Green, 2004). A positive and convex flow-performance relationship has been observed in a number of studies on domestic mutual funds (e.g. Sirri and Tufano, 1998; Del Guercio and Tkac, 2002; Lynch and Musto, 2003; Elton, Gruber and Busse, 2004; Barber, Odean and Zheng, 2005; Bollen, 2007; Jennifer Huang, Wei and Yan, 2007). The disproportionately less outflows from bottom performers could be explained by a disposition effect, which refers to the behavior pattern that investors are reluctant to realize losses but eager to realize gains (Barber, Odean and Zheng, 2000; Del Guercio and Tkac, 2002; Wermers, 2003; Kaustia, 2004; Frazzini, 2006; Ivković and Weisbenner, 2009; Cici, 2010; Bailey, Kumar and Ng, 2011). As predicted by prospect theory, investors become risk averse in the domain of gains and tend to increase holdings of past winners but they dislike the feeling of regret and are willing to gamble in the domain of losses in the hope that they will recover some day. Thus, we expect to find evidence of a convex flow-performance relationship for UK domestic and international equity mutual funds. In addition, we anticipate that domestic fund investors show more aggressive return chasing behavior than their international peers. According to the theory of rational expectations, an agent's expectations can be expressed as $E_{i,t-1}x_{t+k} = E\left[x_{t+k}\middle|I_{i,t-1}\right] + \mu_{i,t}$, where $I_{i,t-1}$ indicates all the information available to an agent i at the beginning of time t and $\mu_{i,t}$ is the error term representing idiosyncratic influence or factors. $E_{i,t-1}x_{t+k}$ denotes agents' prediction on the value of a variable x at time $t+k$ $(k \geq 0)$, which is made at the beginning of time t while $E\left[x_{t+k}\middle|I_{i,t-1}\right]$ represents the "true expectation" for variable x_{t+k} conditional on prior information set. It worth noting that the information set $I_{i,t-1}$ should be sufficient for an agent

to establish the true expectation on possible values of variable x at time t. Situations such as limited access to information set $I_{i,t-1}$ will prevent agents from making rational expectations. In a market where acquiring and processing information is not free, the information set or the amount of information acquired is determined by agents who tradeoff cost and benefit arising from obtaining the information set. Grossman and Stiglitz (1980) pointed out that since the information gathering and analysing process is costly, excess returns are required to cover this cost to maintain the incentive for investors to collect information and retain the "fair" price. From Berk and Green (2004)'s perspective, investors chase past superior performance as it reveals manager ability. Compared to domestic fund investors, international fund investors are subject to extra uncertainty including exchange rate fluctuations[36], political risk, barriers to investment, which affects their returns and makes it more difficult for them to update their expectations and beliefs on managerial skill. Therefore, international fund investors are less likely to switch funds based on past performance only, as it is more difficult for them to infer genuine managerial skill. They would be persuaded to switch fund only when the extra anticipated returns are high enough to compensate the costs of switching funds, beyond certain "threshold". This "threshold" also applies to domestic funds, but can be much lower compared to international funds. Besides, as one of the main motivations for international fund investors investing globally is to capture diversification benefits, international fund investors are more likely to have a consistent investment strategy which matches their return expectation and risk preference and less likely to rebalance their investment portfolio frequently. In addition to the different client characteristics, Sirri and Tufano (1998) also point out that search and participation costs are important determinants of the flow-performance relationship. The higher costs in evaluating and responding to past performance for international fund investors can prevent them from exerting aggressive return chasing behaviour.

Hypothesis 13: *The convexity in the flow-performance relationship is affected by search costs for both UK domestics and international equity mutual funds.*

According to Sirri and Tufano (1998), search costs are the costs incurred when investors collect and process information about performance and other fund characteristics. Lower

[36] Exchange rate fluctuations are found to be an important determinant of international mutual fund performance. Check Table 6.9 in Appendix for the results of panel regressions of international fund performance on exchange rate fluctuations.

search cost combined with good performance record can make a fund more 'salient' to investors. Jennifer Huang, Wei and Yan (2007) further define participation costs as the information cost of collecting and analyzing information about a new fund before investments are made and the transaction cost of purchasing and redeeming fund shares. They argue that investors' level of financial sophistication can significantly affect the convexity of flow-performance relationship. Past performance should exceed a threshold value for an investor to realize a utility gain and attracts those individuals with higher costs to overcome their participation barriers. Following Sirri and Tufano (1998) and Jennifer Huang, Wei and Yan (2007), we use fund family size and fund total expenses, which are widely employed as two material measures of search costs to examine the effect of these two factors on flow-performance sensitivity. Mutual funds affiliated with a large fund family, which offers a large number of different investment objectives and types of investment vehicles is easier to attract investor attention as it lowers the search costs as well as switch costs (e.g. Jennifer Huang, Wei and Yan, 2007; Zhao, 2008). Funds that belong to large fund families normally enjoy higher brand awareness, which also lowers the search costs for investors. Lower search costs can amplify the effect of past performance on fund flows as marketing and advertising makes performance more salient (Sirri and Tufano, 1998). Jennifer Huang, Wei and Yan (2007) argue that fund flows can be more sensitive to past performance for top performers with a higher participation costs as they have to generate a rate of return, which is high enough to compensate for the participation costs and attract investors. Mutual funds with higher marketing expense are also considered to have lower search cost. According to Sirri and Tufano (1998), higher marketing expense has two contrary effects on flow-performance sensitivity. Higher fees, despite of lowering search costs, increase the cost of investing in a fund, therefore might drive away potential investors especially for those underperformed funds.

6.2 Methodology and Data

6.2.1 Methodology

6.2.1.1 Fund Flows

In line with existing literature on flow-performance relationship (e.g. Gruber, 1996; Sirri and Tufano, 1998; Goriaev, Nijman and Werker, 2008; Ferreira et al., 2012), we base our analysis on the relative measure for fund flows, which is defined in Chapter 4. However, Del Guercio and Tkac (2002) argue that the relative measure of fund flows is preferred when a positive relationship between flows and fund size is detected. When a negative relationship between fund flows and lagged fund size is displayed, it is better to control for the potential size effect in regression model rather than utilize percentage flows. In our sample, quarterly absolute fund flow is negatively related to fund size with correlation coefficients of -0.09 for international mutual funds and -0.124 for UK domestic unit trusts at 5% significance level. Therefore, to make the study robust, we also apply the absolute measure for fund flows[37], which is also defined in Chapter 4.

Both definitions of fund flow implicitly assume that all earnings will be automatically reinvested into the fund and flows occur at the end of measuring period. However, the relative measure of fund flows might be biased for new funds as it attributes all change in net asset value to internal growth (Berk and Green, 2004). Berk and Tonks (2007) also pointed out that funds could be either liquidated or merged at the end of their life. For liquidated and merged funds, we could set the net percentage flow as -100% and net pound flow as the negative of net asset value since the current fund manager loses all funds under management. Nevertheless, the assets of the merged funds will go to some new funds and result in extremely large inflows to some newly founded small funds (Berk and Tonks, 2007). In this situation, we could either follow Berk and Tonks (2007) to remove funds with very small initial size or winsorize the datasets to rule out outliers. Following Goriaev, Nijman and Werker (2008) we winsorize net percentage flows and absolute flows at the 0.75th and

[37] The use of relative and absolute fund flows depends on the research question we investigate, and the measure used in existing literature. In the first section of basic flow-performance relationship, we use both relative and absolute measure of fund flows following Del Guercio and Tkac (2002). In the second and third sections regarding convexity and sensitivity of flow-performance relationship, we use net percentage flow in the analysis following Sirri and Tufano (1998) and Jennifer Huang, Wei and Yan (2007).

99.25th percentage for UK domestic and international mutual funds.

Typically fund flows are measured at annual or quarterly frequencies (e.g. Sirri and Tufano, 1998; Del Guercio and Tkac, 2002; Jennifer Huang, Wei and Yan, 2007; Goriaev, Nijman and Werker, 2008; Ferreira et al., 2012). Annual measures of fund flows are most widely used in fund studies and some researchers argue that short-term cash outflow and inflow might be due to liquidation and portfolio rebalancing needs other than fund performance (Del Guercio and Tkac, 2002). Limited by the length of sample period and to allow for a comparison with the existing literature, we use quarterly measures instead of annual fund flows to explore investors' investment and redemption behavior.

6.2.1.2 Fund Performance

We use alternative performance measures in our analysis. Raw returns are defined as net monthly returns accumulated over certain time horizons, which are 12 months (short term) and 36 months (long term) without adjusting for risk. Risk-adjusted returns include Abnormal Returns and Jensen's Alphas. Monthly abnormal Returns for each fund are computed as the difference between realized monthly net returns of that fund and the expected returns estimated from factor models. The results reported are mostly based on the single factor model and Carhart four factor model. The risk factors for domestic and international mutual funds are obtained from difference sources as described in Chapter 4. The coefficients are computed based on both whole sample regression and rolling regression over previous 36 months for each fund to derive the abnormal returns for individual UK domestic and international mutual funds. In addition, annualized alphas are computed as the intercepts of regressions over the previous 36 months and then annualized for each fund.

6.2.1.3 Basic Regression Models

To examine the flow-performance relationship for UK domestic and international unit trusts, we develop a basic regression model in Chapter 4 (equation 4.2). This basic model can be adapted to different scenarios and different research questions. To investigate the convexity of flow-performance relationship, we employ the piecewise linear regression approach proposed by Sirri and Tufano (1998) in section 6.3.2. To implement the approach, we replace the original performance measures with fractional ranks based on alternative performance measures. According to Sirri and Tufano (1998), the fractional rank ($RANK_t$) of a fund i indicates "its percentile performance relative to other funds with the same objective in the

same period", which ranges from 0 to 1. The ranks for funds in the worst performing quintile are calculated as Min ($RANK_{t-1}, 0.2$). Mid represents the combination of the middle three performance quintiles and defines the ranks for funds in this group as Min (0.6, $RANK_{t-1} - Low$). The ranks for funds in the top performing quintiles (High) are computed as $RANK_{t-1} - Mid - Low$. After obtaining the ranks, we run regressions year-by-year as in Fama and MacBeth (1973) to explore the sensitivity of flows to past performance (e.g. Sirri and Tufano, 1998; Jennifer Huang, Wei and Yan, 2007). The piecewise linear regression can be expressed as:

$$Flow_{i,t} = \gamma_0 + \gamma_1 Low_{i,t-n} + \gamma_2 Mid_{i,t-n} + \gamma_3 High_{i,t-n} + \gamma_4 Fund\ Charateristics_{\ i,t-1} + \gamma_5 Control\ Variables_{i,t-1} + \varepsilon_{i,t} \quad (6.1)$$

where $Low_{i,t-n}$, $Mid_{i,t-n}$, $High_{i,t-n}$ are fractional ranks based on alternative performance measures for fund fund i at time $t-n$ and n stands for the number of lags.

To examine the impact of participation and search costs on the sensitivity of fund flows to past performance in section 6.3.2, we interact the variable of interest with the performance ranks and then run the modified regression based on equation (6.1). Based on the availability of the data, we choose to measure participation and search costs using fund total fees[38] and fund family size following Sirri and Tufano (1998) and Jennifer Huang, Wei and Yan (2007). Sirri and Tufano (1998) identified three measures as proxies to search costs, which are fund complex size, marketing and distribution expenditure, and media coverage. Mutual funds that belongs to large fund families are considered to enjoy greater brand awareness and relatively easier to be identified by clients. Fund fees, especially marketing expenses charged by funds via loads and 12b-1 fees also increase brand recognition and lower investors' search cost. Therefore, total fees including marketing expenditure and fund family size are considered as important indicators of investor's search and participation costs (Sirri and Tufano, 1998), which are expected to exhibit great influence on investor behavior. Although the data on mutual fund fees is incomplete in our analysis and we have no access to total expense ratio and fee structure of each fund, we expect that annual management fees also contain some information on marketing and selling efforts made by fund managers and impact the sensitivity of fund flows to past performance.

[38] Annual Management Charge plus geometric average of load fee amortized over five years are utilized as proxy to fund total fee.

6.2.2 Data

We analyse the determinants of fund flows and the sensitivity of fund flows to past performance for UK domestic and international equity mutual funds using the same sample employed in Chapter 5. After requiring a minimum of 20 consecutive months of return data for funds to be included in analysis, we have a sample consisting of 650 UK domestic unit trusts of 627 UK-based international equity unit trusts over a period from January 1998 to March 2015. In addition to monthly returns, which are reported net of on-going operating and trading costs as well as management fees, information on investment schemes, fund size, initial charge, exit charge, annual management fees, parent company of each fund, IMA sectors or Lipper schemes for each fund are also obtained. Details of sample construction and description have been discussed in Chapter 4.

6.3 Empirical Results

6.3.1 Basic Flow-Performance Relationship

6.3.1.1 Determinants of Fund Flows: Raw or Risk-adjusted Return Matters?

Table 6.1 displays estimates of the determinants of fund flows for UK-based International equity mutual funds and domestic unit trusts when alternative performance measures are utilized over the sample period January 1998 to March 2015. Both relative measure and absolute measure of fund flow are utilized to draw inferences in section 6.3.1. However, to allow for comparisons with existing literature, we focus on net percentage flow for analyzing convexity of flow-performance relationship and flow-performance sensitivity in section 6.3.2. To examine what type of performance is more significant in determining future fund flows, we include both lagged net returns[39] as a proxy for raw returns and lagged Jensen's alpha as a measure of risk-adjusted performance as well as squared lagged net returns to capture the widely documented non-linearity in flow-performance relationship into our regression analysis based on equation (4.2). An interaction term of quarterly time dummy and a dummy variable for fund scheme is also controlled in the regression model following Del Guercio and Tkac (2002). To account for the potential correlation between lagged net return and Jensen's alpha, we run equations for lagged net return (Model 1) and alpha (Model 2) separately first and then the whole regression including both lagged net return and Jensen's alpha (Model 3).

From Table 6.1 it can be seen that both Jensen's alpha and lagged net return are significantly related to future fund flow. Flow-performance relationship seems to be similar for international mutual funds and UK domestic mutual funds when fund flows are regressed on lagged net returns only. However, when fund performance is measured by Jensen's alpha, fund flows are observed to be more sensitive to performance measured on a risk adjusted basis for both types of funds. When lagged net return and alpha are combined into regression analysis, for international mutual funds, 1% higher alpha performance attracts 0.32% additional net asset growth or 0.38 million net pound flow when performance is measured by one-factor model while 1% increase in one-factor alpha performance is rewarded with 0.28%

[39] Del Guercio and Tkac (2002) suggest using returns in excess of market benchmark instead of net returns in the pooled regression. However, we note that excess return and alpha are potentially correlated as they both of them are functions of the market return. Hence, we use net returns in the analysis and run regressions on net returns and alphas separately first to address this issue. In unreported robustness test, we obtain identical inferences when we replace net returns with excess returns.

net asset growth or 0.32 million net pound flow for domestic equity funds. Compared to Jensen's alpha, lagged net return is significant but less important in determining future fund flow for both types of funds. International fund investors seem to be more sensitive to risk-adjusted returns than domestic fund investors. The sensitivity of relative flow to one-factor alpha is about 2.3 times higher than to lagged net return for international fund investors while the estimated coefficient on one-factor alpha is only 1.2 times higher than that on lagged net return for domestic fund investors. The difference is more obvious when absolute flow is utilized for analysis as the sensitivity of absolute flow to one-factor alpha is 7.4 times higher than to lagged net return for international equity mutual funds but only 1.8 times higher for domestic mutual funds. This finding is consistent with our hypothesis. International mutual fund shareholders, who are characterized as wealthier, better educated and more sophisticated know well about the risks involved in making oversea investment. They are willing to take the extra risk with the expectation to earn higher abnormal returns for the given level of risk, and hence, more likely to incorporate risk adjustments into measuring fund performance. Fund flows into domestic mutual funds are slightly more sensitive to unadjusted raw returns than fund flows into international mutual funds. The estimated coefficient of relative flow on lagged net return for international mutual funds is approximately 4 basis points less than that for domestic mutual funds. However, it seems that although domestic fund investors are more likely to base their investment decisions on raw returns compared to international fund investors, domestic fund flows are still slightly more sensitive to risk-adjusted returns. One possible explanation can be that domestic investors who have information advantage over local markets may use risk-adjusted performance indirectly. The fund advertisements and ratings published on local newspapers, magazines and websites that can impact domestic investor's decision-making have already incorporate risk adjustments into performance measure. If domestic fund investors make investments accordingly, they will use risk adjusted returns unconsciously.

Table 6. 1: Determinants of Fund Flows into UK-based International Equity Mutual Fund and UK Domestic Equity Mutual Funds

	UK-based International Funds						UK Domestic Funds					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
	Percentage Flow	Absolute Flow	Percentage Flow	Absolute Flow	Percentage Flow	Absolute Flow	Percentage Flow	Absolute Flow	Percentage Flow	Absolute Flow	Percentage Flow	Absolute Flow
Net Return t-1	0.200***	11.103***			0.139***	5.158**	0.250***	21.909***			0.233***	18.349***
	(0.015)	(1.442)			(0.023)	(2.530)	(0.014)	(2.058)			(0.022)	(3.190)
Alpha t-1			0.423***	39.858***	0.323***	37.960***			0.428***	44.224***	0.277***	31.858***
			(0.030)	(3.297)	(0.034)	(3.816)			(0.026)	(3.766)	(0.030)	(4.281)
Net Return^2 t-1					-0.074**	-6.128*					-0.026	3.383
					(0.030)	(3.331)					(0.037)	(5.318)
Flow t-1	0.121***	0.368***	0.087***	0.363***	0.081***	0.360***	0.158***	0.375***	0.168***	0.377***	0.160***	0.374***
	(0.008)	(0.007)	(0.009)	(0.008)	(0.009)	(0.008)	(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
Risk t-1	-0.054	-17.717	-0.064	-38.934**	0.042	-29.558	-0.217	-42.958**	-0.415**	-44.489*	-0.154	-36.732
	(0.165)	(15.708)	(0.176)	(19.594)	(0.183)	(20.517)	(0.148)	(21.565)	(0.164)	(23.575)	(0.179)	(25.917)
Fee t-1	-0.004*	0.259	-0.004*	0.529**	-0.003*	0.537**	-0.001	0.229	-0.002*	0.117	-0.002	0.134
	(0.002)	(0.202)	(0.002)	(0.226)	(0.002)	(0.231)	(0.001)	(0.142)	(0.001)	(0.147)	(0.001)	(0.149)
TNA t-1	-0.015***	-0.007***	-0.010***	-0.007***	-0.011***	-0.007***	-0.009***	-0.005***	-0.010***	-0.005***	-0.010***	-0.005***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Age t-1	-0.020***	-1.284***	-0.004	-1.485***	-0.004	-1.569***	-0.017***	-1.480***	-0.015***	-1.277***	-0.015***	-1.266***
	(0.003)	(0.238)	(0.003)	(0.328)	(0.003)	(0.333)	(0.002)	(0.247)	(0.002)	(0.253)	(0.002)	(0.256)
Family Size t-1	0.005***	0.000	0.003***	-0.000	0.003***	-0.000	0.002**	-0.000	0.002**	-0.000	0.002***	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)

Correlation t-1	-0.032**	-1.969	-0.029*	-1.548	-0.031*	-1.546						
	(0.016)	(1.531)	(0.016)	(1.766)	(0.016)	(1.805)						
FX t-1	0.002	0.134	0.001	0.175	0.002	0.205						
	(0.002)	(0.152)	(0.002)	(0.180)	(0.002)	(0.183)						
Constant	0.111***	4.474	0.111***	9.885***	0.128***	10.549***	0.090***	6.887***	0.116***	6.843***	0.120***	7.217***
	(0.038)	(3.601)	(0.032)	(3.492)	(0.032)	(3.569)	(0.018)	(2.603)	(0.017)	(2.326)	(0.017)	(2.382)
Observations	16,438	16,485	13,857	13,883	13,584	13,610	19,518	19,509	18,405	18,395	18,047	18,038
R-squared	0.079	0.189	0.055	0.197	0.058	0.197	0.076	0.193	0.075	0.198	0.083	0.200

Table 6.1 reports results of the pooled time-series cross-sectional regression of absolute and relative fund flows on past performance for 650 UK domestic unit trusts and 627 UK-based international equity mutual funds over the sample period from January 1998 to March 2015. Fund flows are measured on a quarterly basis. Two performance measures are adopted: lagged annual net returns and annualized Jensen's alpha estimated from single-factor model over previous 36 months. We include a vector of control variables: lagged fund flows, fund risk, total fees, fund size, fund age, fund family size for both types of funds and the correlation between international fund return and domestic market return, changes in exchange rate for UK-based international funds only. We also include as regressor but do not report, an interaction term of quarterly time dummy and fund scheme dummy. Fund schemes for UK domestic unit trusts are UK All Companies, UK Equity Income and UK Smaller Companies following the definition of IMA sectors. Fund Schemes for UK-based international equity mutual funds are defined by Lipper based on a fund's regional focus and investment objectives, for instance, Equity Asia Pacific Small& Mid Companies. To account for the potential correlation between lagged net return and Jensen's alpha, we run equations for lagged net return (Model 1) and alpha (Model 2) separately first and then the whole regression including both lagged net return and Jensen's alpha (Model 3). Standard errors are reported in parentheses. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 6.1 shows that fund flow has significant persistence in both international and domestic equity mutual funds. Past fund flows are positively predictive of future fund flows, which can be explained by the informed trading hypothesis raised by Froot and Donohue (2002, 2004). The observed aggregate fund flow persistence might stem from conditional autocorrelation when informed traders try to hide the positive information they have to reduce total price impact by intentionally deferring some purchases into the future (Froot and Donohue, 2002). Alternatively, lags in investment decision making and completing transactions, which arise when investors process and respond information at different speed may also cause a form of investor herding and aggregate flow persistence (Froot and Donohue, 2002). For international funds, apart from the mechanical leads and lags in investment decision-making and transaction implementation mentioned above, within-fund contagion effect and wealth-effect-driven rebalancing transactions seem to be the main reason behind fund flow persistence (Froot and Donohue, 2002). Money flows into or out of one market may result in predictable fund flows into or out of another market. Fund wealth fluctuations in one country may also trigger rebalancing money inflows and outflows from some other countries. If there are mechanical leads and lags in these transaction, we would see aggregate fund flow persistence. UK domestic fund investors display an aversion to invest additional money in riskier funds, given the negative coefficients on fund risk. However, this aversion is not significant for UK international unit trusts and has very limited negative effect on fund flows into international mutual funds. 1% increase in domestic funds' standard deviation can result in around 0.4 million pounds money outflow. Existing evidence has suggested that increased level of wealth and educational attainment of international fund investors are considered to be associated with higher risk tolerance (e.g. Grable, 2000; Hallahan, Faff and McKenzie, 2004; Zhao, 2008). It is worth noting that although reducing overall risk level of investment portfolio through global diversification is one of the main motivations for international fund investors, the risk appetite for international mutual funds with certain investment objective largely depends on investors' personal characteristics and financial status. For instance, international fund investors who seek for global diversification might be more risk averse than investors who are more willing to benefit from potential gains from emerging markets. It has been well documented that domestic fund investors are sensitive to expenses and fees (Sirri and Tufano, 1998). We find some evidence of negative effect of expenses on future fund flows for domestic funds while international fund investors are found to be sensitive to expenses. This

finding is not consistent with existing evidence that suggests no significant correlation between expenses and future fund flows in international equity mutual funds (Zhao, 2008). The higher expense associated with investing in international funds might be an important consideration that prohibits international fund investors from switching between funds. It is worth noting that these findings are derived from analyzing the entire sample, which includes an expansion period from 1998 to 2007 and a recession and recovery period from 2008 to 2015. 2007-2008 financial crisis might have great impact on both international and domestic fund investors' attitude towards risk and expenses. Therefore, below in Table 6.2 we split our sample into two subsamples: pre-2008 and post-2008 to investigate whether the sensitivity of fund flows to past performance changes over time.

For both international and domestic mutual funds, larger funds and older funds are less attractive to investors while funds from larger fund family grow more quickly. Funds belonging to large fund family or fund complexes can benefit from lower search costs and spillover effect (Sirri and Tufano, 1998; Nanda, Wang and Zheng, 2004). In addition, large fund family may offer more investment options, for example, mutual funds with different investment objectives and lower switch costs (Zhao, 2008). For international funds, we control for two additional variables, which are changes in exchange rates and correlation of international fund return with domestic equity market return. Correlation is found to be negatively correlated with future fund flows. International funds that are less correlated with the domestic market can attract higher fund flows, which is consistent with investors' desire of global diversification (Zhao, 2008; Patro, 2010). We find that fund flows into international mutual funds appear to be positively but not significantly related to changes in exchange rates in our sample.

Table 6.2 compares the flow-performance relationship in the two sub-periods: 1998.1-2007.12 and 2008.1-2015.3. We observe that for international mutual funds, risk-adjusted return has greater effect on future fund flows than lagged net return before and after the 2008 financial crisis, which indicates that international fund investors always consider risk-adjusted return as a better measure of fund performance and base their investment decisions primarily on risk-adjusted performance rather than unadjusted raw returns. In contrast, domestic fund investors do not consistently chase risk-adjusted return. Before the 2008 financial crisis, domestic fund investors are more likely to direct their money into funds with higher lagged net returns. 1% increase in lagged net return results in 0.27% additional net asset growth

while 1% higher alpha attracts 0.21% net fund inflows. This finding is in accordance with well documented raw return chasing behavior among domestic fund investors (e.g. Gruber, 1996; Sirri and Tufano, 1998). During and after 2008, risk-adjusted return becomes more important in determining future fund flows for domestic fund investors. 1% increase in alpha performance attracts 0.36% net fund inflow while 1% increase in lagged net return only incur 0.20% net fund inflow. It seems that domestic fund investors learn from the scary experience of 2008 financial crisis and start to incorporate risk adjustments more in performance measures during and after the 2008 financial crisis. They tend to chase past risk-adjusted return rather than simply pursue past raw return after the financial crisis.

From Table 6.2 it can be seen that domestic fund investors appear to be likely to invest in risky funds in expansion periods and more reluctant to incur high risk in recession periods compared to international fund investors. Before 2008, 1% increase in domestic funds' standard deviation can result in around 0.6% additional net asset growth or 0.65 million pounds inflow while after 2008, 1% increase in standard deviation lead to 0.45%, or 0.96 million pounds net money outflow. This finding is analogous to our discussion on changes in return chasing behavior. In expansion periods, i.e. 1998-2007, some domestic fund investors who are optimistic and confident about future prosperity might actively take higher risk with expectation to achieve higher abnormal return while some domestic fund investors who simply chase past raw returns unintentionally invest in past outperformers with higher risk. During and after the 2008 financial crisis, risk becomes an important factor that affects domestic fund investors' decision-making process. Their risk tolerance decreases while risk perception increases (Hoffmann, Post and Pennings, 2013). When risk adjustments are incorporated in measuring performance, investments with higher risk can be less attractive to domestic fund investors. Investors' attitude towards expenses and fees also change during our sample period. Before 2008, fund flows into international funds are not significantly correlated with expenses and fees while domestic funds with higher fees grow more rapidly. Nevertheless, fund flows into domestic funds are negatively related to fee charges after 2008. According to Sirri and Tufano (1998), high fees can be reward for abnormal managerial skills possessed by outperformed fund managers. It also indicates higher marketing effort that lowers investors' search cost and participation barriers. However, higher fees can lead to poorer performance for a domestic equity mutual fund as it increases the price of the fund. Since we find significant evidence of superior risk-adjusted performance of domestic equity

mutual funds in expansions, but little evidence of value added by active management during recession periods, one possible explanation for the observed positive relationship between expenses and fund flows before 2008 might be that domestic fund investors perceive the higher fees as reward for superior performance achieved by fund manager especially when they use raw return instead of risk-adjusted return to measure performance. The higher expenses, which are spent on marketing also decrease the search costs borne by the investors. However, during financial crisis, domestic fund investors fear high fees might result in even poorer performance. The negative effect of higher fees on the attractiveness of domestic equity funds becomes more prominent in recessions.

Table 6. 2: The Flow-Performance Relationship over Time

	UK-based International				UK Domestic			
	1998.1-2007.12		2008.1-2015.3		1998.1-2007.12		2008.1-2015.3	
	Percentage Flow	Absolute Flow	Percentage Flow	Absolute Flow	Percentage Flow	Absolute Flow	Percentage Flow	Absolute Flow
Flow t-1	0.063***	0.285***	0.096***	0.389***	0.114***	0.296***	0.204***	0.424***
	(0.014)	(0.014)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.009)
Jensen's Alpha t-1	0.341***	50.421***	0.321***	30.548***	0.214***	26.470***	0.362***	34.786***
	(0.060)	(6.059)	(0.045)	(5.200)	(0.039)	(5.637)	(0.049)	(6.917)
Raw Return t-1	0.179***	8.216*	0.136***	8.679***	0.270***	24.655***	0.200***	12.121**
	(0.045)	(4.541)	(0.029)	(3.349)	(0.030)	(4.422)	(0.034)	(4.772)
Raw Return^2 t-1	-0.045	-3.793	-0.090**	-8.090**	-0.054	1.775	-0.036	2.447
	(0.059)	(5.898)	(0.035)	(4.102)	(0.051)	(7.508)	(0.054)	(7.638)
Risk t-1	-0.004	12.033	0.118	-21.428	0.609**	65.492	-0.448*	-96.113***
	(0.381)	(38.131)	(0.211)	(24.862)	(0.278)	(40.519)	(0.248)	(35.273)
Fee t-1	-0.005	-0.077	-0.003	0.539*	0.001	0.576***	-0.004***	-0.243
	(0.004)	(0.389)	(0.002)	(0.290)	(0.001)	(0.210)	(0.002)	(0.215)
TNA t-1	-0.020***	-0.016***	-0.009***	-0.005***	-0.008***	-0.000	-0.011***	-0.006***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)
Age t-1	0.007	1.115**	-0.009**	-2.470***	-0.017***	-2.066***	-0.012***	-0.685*
	(0.006)	(0.567)	(0.004)	(0.418)	(0.003)	(0.374)	(0.003)	(0.355)
Family Size t-1	0.003	0.000	0.003**	-0.000	0.001	-0.000	0.003***	-0.000
	(0.002)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Correlation t-1	-0.010	2.982	-0.033	-1.623				
	(0.027)	(2.668)	(0.021)	(2.507)				
FX t-1	0.003	1.280**	0.002	0.159				
	(0.005)	(0.526)	(0.002)	(0.200)				
Constant	0.147***	3.948	0.071**	10.232***	0.084***	1.356	0.128***	9.807***
	(0.046)	(4.453)	(0.032)	(3.695)	(0.021)	(2.928)	(0.020)	(2.610)
Observations	4,773	4,784	8,560	8,575	8,696	8,694	8,999	8,992
R-squared	0.054	0.173	0.057	0.219	0.070	0.131	0.102	0.273

Table 6.2 reports results of the pooled time-series cross-sectional regression of absolute and relative fund flows on past performance for UK domestic and international equity mutual funds over two subperiods: January 1998 – December 2007 and January 2008 – March 2015. Definitions of dependent and independent variables are identical to those in Table 6.1. White standard errors are reported in parentheses. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

6.3.1.2 Fund Flows and Distributed Lag of Past Performance

Table 6.3 presents the difference in flow-performance sensitivity pattern for international and domestic equity mutual funds. Goriaev, Nijman and Werker (2008) found that fund flows were most sensitive to past performance, especially when past performance was released six months ago in 1990s but relied more on most recent information after 2000s. We are interested in testing whether this pattern also applies to UK investors and whether international fund investors react differently to distributed lag of past performance from domestic fund investors. Following Berkowitz and Kotowitz (2000), which is closely related to Goriaev, Nijman and Werker (2008), we regress percentage fund flow on historical quarterly performance to examine the lag pattern for reaction of cash flows to past performance. The fixed effect model is specified as follows:

$$Flow_{i,t} = \alpha_i + \sum_{j=1}^{12} \alpha_j \, Return_{i,t-j} + \beta_{13} LogTNA_{i,t-1} + \beta_{14} VAR_{i,t-1} + \beta_{15} C_{i,t-1} + \beta_{16} TD_{i,t} + \beta_{17} TS_{i,t} + \varepsilon_{i,t} \quad (6.2)$$

where $Flow_{i,t}$ is quarterly percentage fund flow, $Return_{i,t-j}$ represents quarterly abnormal returns, calculated using factor loadings estimated over previous 36 months from CAPM, Fama-French three-factor model, Carhart four-factor model respectively with j represent jth lag, $LogTNA_{i,t-1}$ is the logarithm of total net asset at the end of previous quarter, $VAR_{i,t-1}$ is the variance of fund quarterly returns at $t-1$, $C_{i,t-1}$ is a vector of control variables include fund age, total expenses, fund family size for both international and domestic funds and quarterly changes in exchange rates and correlation between fund return and domestic market return over previous 12 months for international funds, $TD_{i,t}$ represents the quarterly time dummy and $TS_{i,t}$ is the interactive terms of quarterly time dummy and fund scheme dummy.

The results reported in Table 6.3 are based on abnormal returns derived from CAPM. Similar results are obtained when we use alternative factor models. The significant coefficient 0.347 for the first lag of abnormal returns shows that percentage flow is most sensitive to the previous quarter's abnormal return, that is, the most recent performance for international mutual funds. This suggests that international fund investors in general update the performance information in a timely manner. It might help them capture the short-term persistence in mutual fund performance (Goriaev, Nijman and Werker, 2008). Domestic fund investors, in contrast, react to past performance with a lag. For domestic unit trusts, fund flow is most sensitive to performance information disseminated six months ago. It suggests that

domestic fund investors do not update performance information as frequently as their international peers. We find a decreased sensitivity of domestic investor fund flows to risk-adjusted returns after one-year lag. Our results are similar to Cashman et al. (2014). They compare the flow-performance relationship across fund types and find that the impact of monthly performance on future fund flows lasts for up to twelve months for US domestic equity mutual funds while the effect of past performance on international mutual fund money flows is more short-lived, which lasts for only one or two months. The difference in flow-performance sensitivity pattern between international and domestic equity mutual funds might be attributed to information asymmetry between domestic and foreign investors. International fund investors who are less well-informed revise their expectation about returns more than the better-informed domestic investors following a public signal. Domestic investors, though respond to public signals with a lag, might obtain information advantage from the gradual process of acquisition of superior information about signal realization.

In unreported analysis[40], we examine the lag pattern for reaction of cash flow to past performance for two sub-periods: January 1998 to December 2007 and January 2008 to March 2015. Before the financial crisis, international fund investors take longer lags for instance the ninth and tenth lags into consideration when making investment while after financial crisis, longer lags over 18 months have little effect on future investor flows. For domestic unit trusts, fund flow is more sensitive to nine-month lagged risk-adjusted performance before 2008 while after 2008 financial crisis, we find an increased sensitivity of domestic investor fund flows to most recent risk-adjusted returns. After one-year lag, domestic individuals are in general insensitive to past performance. It might suggest that financial crisis has changed the investment environment. Therefore, performance information too long ago is not considered relevant to the new situation and has no value in making investment decisions.

[40] The results are presented in Appendix Table 6.10.

Table 6. 3: Fund Flows and Lag Structures for Past Performance

	UK-based International	UK Domestic
Constant	0.515***	0.111
	(0.143)	(0.108)
$Return_{t-1}$	0.347***	0.584***
	(0.061)	(0.078)
$Return_{t-2}$	0.177***	0.617***
	(0.062)	(0.075)
$Return_{t-3}$	0.219***	0.530***
	(0.056)	(0.082)
$Return_{t-4}$	0.273***	0.463***
	(0.074)	(0.073)
$Return_{t-5}$	0.124**	0.223***
	(0.061)	(0.063)
$Return_{t-6}$	0.125**	0.238***
	(0.053)	(0.055)
$Return_{t-7}$	0.031	0.043
	(0.058)	(0.058)
$Return_{t-8}$	0.096	0.111**
	(0.059)	(0.056)
$Return_{t-9}$	0.134***	0.119**
	(0.049)	(0.055)
$Return_{t-10}$	0.095**	0.131**
	(0.045)	(0.054)
$Return_{t-11}$	0.089	0.114**
	(0.056)	(0.049)
$Return_{t-12}$	0.093*	0.140***
	(0.053)	(0.050)
Explanatory Variables include:	Risk, total fees, fund size, fund age, fund family size, quarterly time dummies, scheme dummies and time and scheme interaction dummies for both types of funds. For international funds only: changes in the exchange rates and correlation of fund return with UK domestic equity market return.	
Observations	9,530	11,108
R-squared	0.112	0.086

Percentage flows are regressed on historical quarterly performance to examine the lag pattern for reaction of cash flow to past performance for the entire sample period. Table 6.3 reports the results from estimating the fixed effect model given by equation (6.2). Robust standard errors are reported in parentheses. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

6.3.1.3 Does Beating A Market Benchmark Matter?

In this section, we extend Del Guercio and Tkac (2002) research on whether fund flows are affected by the discrete event of beating a market or by the magnitude of fund outperformance relative to a market benchmark to draw a comparison between domestic mutual funds and international mutual funds in a UK setting. Table 6.4 displays the results of regression to assess the importance of outperforming a benchmark for international and domestic equity mutual funds. Following Del Guercio and Tkac (2002), we create two dummy variables OUTPERF and UNDERPERF. OUTPERF equals one if a fund's lagged net return is greater than the lagged return on certain benchmark index and equals zero otherwise. UNDERPERF equals one if a fund's lagged net return is less than the lagged return on certain benchmark index and equals zero otherwise. To study the effect of beating a market benchmark on fund flows and the potential asymmetric response of fund flows to past performance, we run the following regression by including interactive terms between the dummy variables and performance measurement variables,

$$Flow_{i,t} = \alpha + \beta_0 OUTPERF + \beta_1 OUTPERF * Performance_{i,t-1} + \beta_2 UNDERPERF * Performance_{i,t-1} + \beta_3 TS_{i,t} + \beta_4 Control\ Variables_{i,t-1} + \varepsilon_{i,t} \quad (6.3)$$

where $Performance_{i,t-1}$ represents performance measurement variables: annual excess return[41] and annualized one-factor Jensen's alpha estimated over previous 36 months at $t-1$, $TS_{i,t}$ is a vector of interactive terms between time and fund scheme, and $Control\ Variables_{i,t-1}$ represents a vector of control variables. To meet our research aim, we make some changes to the setting specified by Del Guercio and Tkac (2002). Firstly, in contrast to Del Guercio and Tkac (2002), we compare lagged return net of management fees to the benchmark index to decide whether a fund delivers outperformance or not. Secondly, unlike Del Guercio and Tkac (2002) who choose S&P 500 as a single benchmark to compare the performance of different domestic fund segments with, we use different market indexes as benchmarks for international and domestic funds. Lagged net returns of domestic equity unit trusts are compared to lagged return on FTSE All Shares while FTSE All World is chosen as the market benchmark for international equity mutual funds. We also examine whether outperforming domestic market benchmark index can affect future fund flow to UK-based international equity mutual funds. In unreported analysis, we test our hypothesis with

[41] Excess return equals to net return minus market index return.

alternative benchmarks for international funds such as FTSE Developed World ex-UK, FTSE All World ex US and FTSE All World ex UK. The results are consistent with the findings when FTSE All World is used as benchmark. Thirdly, we do not include tracking error as a measure of diversifiable risk as it has been found to be unrelated to mutual fund manager flows (e.g. Del Guercio and Tkac, 2002; Berk and Tonks, 2007). Instead, we focus on the impact of unadjusted and adjusted performance and control for total risk incurred in mutual fund investment by including standard deviation of net returns in previous 12 months (Sirri and Tufano, 1998; Nanda, Wang and Zheng, 2004; Goriaev, Nijman and Werker, 2008).

The results in Table 6.4 suggest that beating a benchmark is important for both international and domestic equity mutual funds. The coefficients on OUTPERF in column (1), (2), (5) and (6) are both statistically and economically significant. All else equal, beating FTSE All World index alone attracts additional 1.99 million in net pound flow, or 1.8% additional net asset growth for international funds while beating FTSE All Shares index alone increases the total net asset of domestic funds by 4.39 million pounds, or boosts the asset growth rate by 1.9%. It suggests that both international and domestic fund investors might view beating a benchmark as a validation of superior managerial skills, which helps them to make investment decisions. While beating FTSE All World appears to be important for international fund investors, beating a domestic market index has little positive effect on future fund flows. The coefficient on OUTPERF in Table 6.4 is insignificantly different from zero in column (3) and weakly positive in column (4). International fund investors with the sophistication to engage in global diversification are less concerned with the level of performance of international funds relative to domestic market index. It is analogue to the existing evidence on international fund investors' preference over international equity funds that are less correlated with domestic markets to maximize the diversification benefits. Therefore, it seems that international fund investors tend not to use domestic market index as benchmark to measure the performance of international equity mutual funds.

Table 6. 4: The Importance of Beating A Market Benchmark

	UK-based International				UK Domestic	
	FTSE ALL WORLD		FTSE ALL SHARES		FTSE ALL SHARES	
	(1)	(2)	(3)	(4)	(5)	(6)
	Percentage Flow	Pound Flow	Percentage Flow	Pound Flow	Percentage Flow	Pound Flow
Constant	0.144***	14.227**	0.156***	14.749***	0.075***	3.908
	(0.051)	(5.704)	(0.051)	(5.714)	(0.020)	(2.786)
Dummy	0.018***	1.991***	0.002	1.066*	0.019***	4.391***
(outperf market index)	(0.005)	(0.598)	(0.006)	(0.645)	(0.004)	(0.562)
Lagged excess Return t-1	0.242***	3.167	0.291***	7.782	0.219***	11.187**
(outperform)	(0.045)	(5.012)	(0.044)	(4.875)	(0.037)	(5.380)
Lagged excess Return t-1	0.156***	7.602	0.209***	9.350*	0.188***	-7.263
(underperform)	(0.051)	(5.701)	(0.050)	(5.649)	(0.043)	(6.251)
Jensen's Alpha t-1	0.380***	77.018***	0.388***	71.434***	0.319***	44.816***
(outperform)	(0.061)	(6.897)	(0.061)	(6.855)	(0.040)	(5.826)
Jensen's Alpha t-1	0.256***	26.240***	0.270***	33.952***	0.170***	15.381**
(underperform)	(0.061)	(6.776)	(0.059)	(6.620)	(0.045)	(6.435)
Control Variables include:	Lagged flow, risk, total fees, fund size, fund age, fund family size and time and scheme interaction dummies for both types of funds, changes in the exchange rates and correlation of fund return with UK domestic equity market return for international funds only					
Observations	13,584	13,610	13,584	13,610	18,047	18,038
R-squared	0.100	0.235	0.099	0.234	0.092	0.208

Table 6.4 reports results of the pooled time-series cross-sectional regression of absolute and relative fund flows on net return in excess of market benchmark index for UK domestic and international equity unit trusts over 1998.1-2015.3. The regression model is estimated from equation (6.3). Fund flows are measured on a quarterly basis. Two performance measures are adopted: lagged annual net returns and annualized Jensen's alpha estimated from single-factor model over previous 36 months. We create two dummy variables OUTPERF and UNDERPERF. OUTPERF equals one if a fund's lagged net return is greater than the lagged return on certain benchmark index and equals zero otherwise. UNDERPERF equals one if a fund's lagged net return is less than the lagged return on certain benchmark index and equals zero otherwise. Interactive terms between time and fund scheme are included in the regression but not reported. Fund schemes for UK domestic unit trusts are the same as IMA sectors. Fund Schemes for UK-based international equity mutual funds are defined by Lipper. Lagged net returns of domestic equity unit trusts are compared to lagged return on FTSE All Shares while FTSE All World is chosen as the market benchmark for international equity mutual funds. White standard errors are reported in parentheses. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

In addition to the discrete event of beating a benchmark, the magnitude of the outperformance is also an important determinant of flow. For domestic funds, significant positive coefficients on lagged excess returns above the benchmark can be found for both pound flow and percentage flow while significant positive coefficients on lagged excess returns below the benchmark can be only found for percentage flow. For international funds, significant positive coefficients on lagged excess returns both above and below the benchmark are observed for percentage flow but not observed for pound flow. The response of future flow to lagged excess return is moderately symmetric across superior and inferior performance for both international and domestic funds. Nevertheless, alpha performance shows an asymmetric impact on fund flows in both international and domestic fund industry. Risk-adjusted performance has a highly statistically and economically significant positive effect on both pound flow and percentage flow. 1% higher alpha performance implies approximately 0.4% growth rate for international funds that outperform FTSE All World and 0.26% growth rate for those underperforms. As for domestic funds, 1% higher alpha performance can result in additional 0.3% growth rate for outperformers and 0.17% for underperformers. The coefficient on alpha is around 1.5 to 2 times larger in the outperforming subsamples of domestic and international funds than the underperforming subsamples. These results indicate that there is an asymmetric flow-performance relationship and a lack of punishment to underperformers in mutual fund industry. It also suggests that the importance of risk-adjusted return in determining fund flow in mutual fund industry might be driven by the impact of alpha performance of funds that beat the market. The convexity in flow-performance relationship will be investigated in depth in the following section.

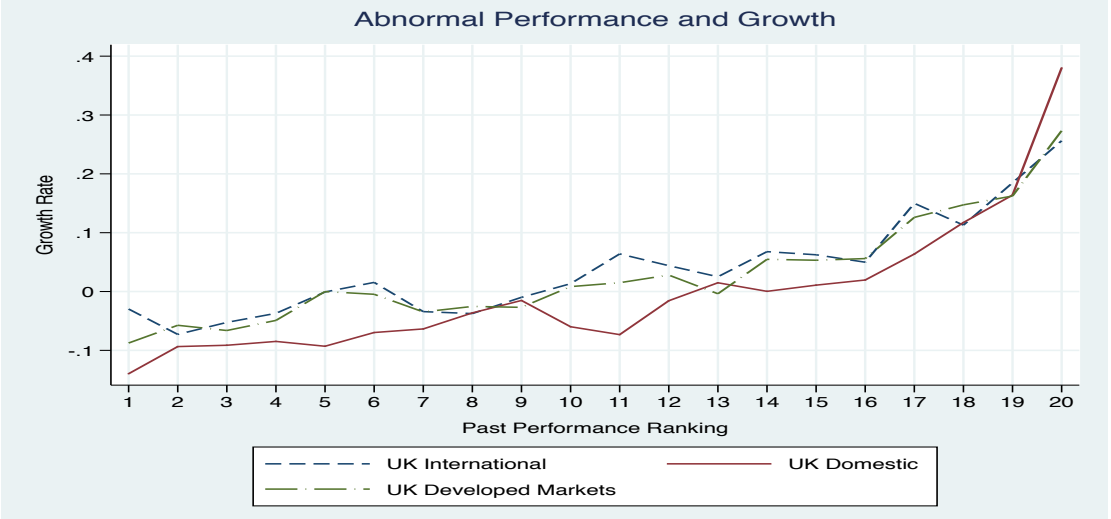
6.3.2 Convexity in Flow-Performance Relationship

6.3.2.1 Convex Flow-Performance Relationship

Figure 6.1 displays the relationship between past performance and subsequent fund flows for UK domestic mutual funds, UK-based international mutual funds and developed market equity mutual funds. As we have demonstrated in previous discussion of results, the flow-performance relationship is in general positive and nonlinear for both UK domestic and international funds, which has also been confirmed in existing literature (e.g. Sirri and Tufano, 1998). In Figure 6.1, for each year from 1998 to 2014, funds are ranked based on their previous one-year performance measured by abnormal returns from the Carhart four-

factor model first and then divided equally into 20 groups. The growth rate is calculated for each group as the mean relative fund flows over the subsequent 12 months, which allows for comparison with Sirri and Tufano (1998). The shape of the flow-performance relationship for UK domestic funds is very similar to the flow-performance relationship for US equity mutual funds exhibited in Sirri and Tufano (1998). However, it exhibits a more convex flow-performance relationship for UK domestic funds in comparison to international and developed market funds. The main difference of the responsiveness of fund flows to past performance between domestic and international funds lies at the extreme tails of the distribution. The sensitivity of fund flows to past performance is greater in the top group domestic funds while the average fund outflows are also larger in the bottom group domestic unit trusts, though both the worst performing UK domestic and international funds experience fund outflows. The plot of flow-performance relationship based on total net returns is very similar to Figure 6.1. So, we would expect the convexity in flow-performance relationship is robust to alternative performance measures for UK domestic and international funds.

Figure 6. 1: Previous Year Total Net Returns and Subsequent 12-month Relative Fund Flows



For each year from 1998 to 2014, funds are ranked based on their one-year abnormal returns from Carhart four-factor model, and then divided into 20 equal groups where 20 indicates the best performing funds and 1 indicates the worst performing funds. For each group, the growth rate is calculated as the mean relative fund flows over the subsequent 12 months.

Table 6.5 reports the results gained from Fama-MacBeth regression of quarterly fund flows on performance ranks based on alternative performance measures for international and domestic equity mutual funds, which are utilized for robustness check. We focus on quarterly net percentage flows to allow for comparison with previous evidence while in unreported analysis, annual percentage flows are employed and generate consistent results.

Following Sirri and Tufano (1998) and Jennifer Huang, Wei and Yan (2007), the performance measures for rankings include one-year and three-year raw returns, abnormal returns estimated over 12 months when the factor loadings are derived from both the entire sample periods and the previous 36 months from Carhart four-factor model, alpha performance obtained from rolling regression of monthly returns on a single market factor and Carhart four risk factors respectively over past 36 month. Control variables included in the regression are aggregate flows to each IMA Sector for domestic funds and aggregate flows to each Lipper Scheme for international funds, fund size, fund age, total expense, fund family size for both types of funds and quarterly changes in exchange rates as well as correlation between fund return and UK domestic market return for international funds only.

We observe that there exists a strong but nonlinear relationship between subsequent fund flows and past performance for both international and domestic equity mutual funds. Performance from two and three years ago is less significant associated with current fund flows while most recent performance especially good performance has a much stronger effect on fund flows. This finding is consistent with our results in section 6.3.1 and most of the existing literature, which documents that fund flows are strongly sensitive to most recent performance information. Funds in the top quintile attract economically and statistically significant inflows while the coefficient on medium and low performance is smaller than on high performance. Consistent with Joseph Chen et al. (2004), we also find a significant positive association between subsequent flow and bottom performance and these funds in the bottom quintile even attract more inflows than those funds in the mid three quintiles. It suggests that both international and domestic fund investors chase past good performance but are reluctant to withdraw money from past losers to realize loss. Fund flows into international funds appear to be less sensitive to past good performance than fund inflows to domestic funds, which means domestic fund investors show a more aggressive return chasing behavior than their international peers.

Table 6. 5: The Effect of alternative Performance Measures on Subsequent Fund Flows

	UK-based International						UK Domestic					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	R_36M	R Lags	FS4F_AR	R364F_AR	1F_36M	4F_36M	R_36M	R Lags	FS4F_AR	R364F_AR	1F_36M	4F_36M
OBJFlow t-1	0.677***	0.614***	0.779***	0.686***	0.705***	0.704***	0.789**	0.853**	0.951***	1.146***	0.869**	0.855**
	(0.092)	(0.096)	(0.127)	(0.149)	(0.107)	(0.114)	(0.381)	(0.390)	(0.275)	(0.2832)	(0.408)	(0.394)
TNA t-1	-0.013***	-0.014***	-0.014***	-0.009***	-0.012***	-0.012***	-0.0084***	-0.0077***	-0.0088***	-0.0046***	-0.0081***	-0.0076***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.0012)	(0.0014)	(0.0017)	(0.0013)	(0.0013)	(0.0013)
Expense t-1	-3.300	-2.087	-3.353	-2.051	-1.298	-1.831	-0.189	0.0975	0.255	0.3647	-0.231	0.985
	(2.616)	(2.783)	(2.101)	(1.960)	(2.122)	(2.049)	(2.193)	(1.851)	(1.923)	(2.4226)	(2.165)	(2.250)
AGE t-1	-0.004	-0.004	-0.021***	-0.008**	-0.005	-0.006	-0.0061***	-0.0065***	-0.0198***	-0.0087***	-0.0065***	-0.0070***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.0017)	(0.0018)	(0.0019)	(0.0023)	(0.0017)	(0.0016)
Family Size t-1	0.002	0.004*	0.003	0.003**	0.003*	0.003*	0.0021**	0.0014	0.0015	0.0009	0.0021**	0.0018*
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.0009)	(0.0009)	(0.0011)	(0.0010)	(0.0009)	(0.0010)
FX t-1	0.008	0.009	-0.000	0.010	0.003	0.004						
	(0.010)	(0.011)	(0.006)	(0.009)	(0.009)	(0.008)						
Correlation t-1	-0.042	-0.031	-0.029	-0.002	-0.050	-0.061						
	(0.035)	(0.026)	(0.030)	(0.034)	(0.041)	(0.048)						
Risk, -1 to -36	0.213				0.275	0.085	-0.599**				-0.156	0.0567
	(0.265)				(0.326)	(0.334)	(0.293)				(0.446)	(0.486)
Risk, -1 to -12		0.638	0.347	0.417				-0.647*	-0.586	-0.1894		
		(0.387)	(0.333)	(0.342)				(0.380)	(0.477)	(0.5493)		
Risk, -13 to -24		0.129						-0.152				

		(0.253)							(0.307)					
Risk, -25 to -36		-0.623***							0.0301					
		(0.218)							(0.266)					
Low, -1 to -36	0.099				0.149***	0.219***	0.0596					0.0618	0.132***	
	(0.063)				(0.048)	(0.041)	(0.0625)					(0.0435)	(0.0420)	
Mid, -1 to -36	0.067***				0.072***	0.043***	0.0706***					0.0713***	0.0632***	
	(0.015)				(0.014)	(0.011)	(0.0117)					(0.0087)	(0.0083)	
High, -1 to -36	0.290***				0.175***	0.209***	0.478***					0.399***	0.348***	
	(0.051)				(0.052)	(0.058)	(0.100)					(0.0990)	(0.0870)	
Low, -1 to -12		0.103*	0.184***	0.091				0.181***	0.149***	0.150***				
		(0.060)	(0.066)	(0.057)				(0.038)	(0.035)	(0.039)				
Mid, -1 to -12		0.048***	0.029***	0.038***				0.074***	0.0562***	0.048***				
		(0.013)	(0.011)	(0.009)				(0.008)	(0.009)	(0.009)				
High, -1 to -12		0.289***	0.379***	0.205***				0.338***	0.403***	0.306***				
		(0.078)	(0.057)	(0.074)				(0.088)	(0.054)	(0.072)				
Low, -13 to -24		0.023						0.0133						
		(0.072)						(0.0607)						
Mid, -13 to -24		0.027**						0.0246**						
		(0.013)						(0.0115)						
High, -13 to -24		0.040						0.0505						
		(0.060)						(0.0554)						
Low, -25 to -36		0.072						0.0502						
		(0.066)						(0.109)						
Mid, -25 to -36		0.019						0.0272***						
		(0.014)						(0.0102)						

High, -25 to -36		0.159***						0.132**				
		(0.053)						(0.0537)				
Constant	0.054	0.003	0.084*	0.012	0.034	0.049	0.0256	-0.0164	0.0546**	-0.0021	0.0210	-0.0007
	(0.051)	(0.046)	(0.044)	(0.040)	(0.058)	(0.063)	(0.0238)	(0.0312)	(0.0243)	(0.0356)	(0.0246)	(0.0272)
Observations	13,193	13,193	16,863	12,621	14,238	14,238	16,663	16,663	19,734	14,672	16,663	16,663
R-squared	0.110	0.152	0.126	0.097	0.102	0.099	0.086	0.129	0.095	0.078	0.084	0.073

Table 6.5 reports coefficient estimates for six separate regressions using quarterly percentage flows as dependent variables for UK domestic and international equity mutual funds respectively. We include various measures on which the fractional performance rank ($RANK_t$), which ranges from 0 to 1, of fund i in the preceding years is based on as independent variables. The ranks ($RANK_t$) for funds in the worst performing quintile Low are calculated as Min ($RANK_{t-1}$, 0.2). Mid represents the combination of the middle three performance quintiles and defines the ranks for funds in this group as Min (0.6, $RANK_{t-1} - Low$). The ranks for funds in the top performing quintiles High are computed as $RANK_{t-1} - Mid - Low$. The measures of past performance include prior 36-month net returns (R_36M), each of the prior three-year's net returns separately (R Lags), annual abnormal return from Carhart four-factor model with constant factor loadings (FS4F_AR) where abnormal returns are defined as the difference between realized monthly net returns of that fund and the expected returns estimated from factor models, annual abnormal return from Carhart four-factor model with time-varying factor loadings estimated over the prior 36 months (F364F_AR), annualized alpha estimates from single factor model over the preceding three years (1F_36M) and annualized alpha estimates from Carhart four-factor model over the preceding three years (4F_36M). The control variables included in the regression are associated fund risk, total fees, fund size, fund age, fund family size, growth rate of net new fund flows into each fund schemes for both UK domestic and international funds as well as the correlation between international fund return and domestic market return and changes in exchange rate for UK-based international funds only. These regressions are run quarter-by-quarter following Fama and MacBeth (1973). Time-series averaged coefficients and the Newey-West robust standard errors (in parentheses) are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

In unreported analysis, we further examine whether the convexity in flow-performance relationship changes before and after 2008 financial crisis. We repeat the test for two subsamples: 1998.1-2007.12 subsample and 2008.1-2015.3 subsample. The results suggest that the sensitivity of subsequent fund flows to low, mid and high performance are stable for international mutual funds before and after financial crisis. Nevertheless, fund inflows to domestic funds are approximately 1.5 to 2 times more sensitive to performance of top performing funds after 2008 than before 2008. Therefore, the return chasing behavior is stronger for domestic mutual fund investors during and after 2008 financial crisis. Besides, we find a more convex flow-performance relationship for the best performing domestic funds even before 2008 financial crisis in comparison to international funds.

Our results suggest that mutual fund investors respond to performance information differently across fund types. Apart from the basic consideration that fund investors have heterogeneous characteristics, international fund investors are subject to exchange rate fluctuations and some extra uncertainty, which may affect their returns. From Berk and Green (2004)'s perspective, investors have more difficulties in updating their expectations of fund manager ability for international funds than domestic funds. Thus, international fund investors are less likely to switch funds based on past performance only especially when the switching costs for international fund investors are much higher than for domestic fund investors and there is possibility that exchange rate movement can dominate the underlying investment returns. The search and participation cost also plays an important role in determining the sensitivity of subsequent fund flows to past performance. International fund investors in general face higher search and participation costs than domestic fund investors, which can prevent them from exerting aggressive return chasing behaviour. Besides, since one of the main motivations for investing globally is diversification benefit, international fund investors are more likely to have a consistent investment strategy which matches their return expectation and risk preference and less likely to be affected by marketing and advertising. There definitely exist some international fund investors who aim at gaining abnormal returns from emerging markets with a relatively higher risk tolerance. Past good performance as a basis for fund marketing and attracting attention can be more salient to these international fund investors. Domestic fund investors, in contrast, are more likely to be affected by advertisement and marketing activities, which significantly lower their search costs especially when they believe it is an information advantage over foreign investors (home bias). It seems that the financial

crisis also triggers herding activity among individual investors (Chiang and Zheng, 2010; Ouarda, El Bouri and Bernard, 2012). Domestic retail fund investors who face less difficulty in learning about managerial ability and lower costs in evaluating and responding to past performance as well as switching funds, are more likely to exert aggressive return chasing behaviour to assure that past losses are recovered, which can lead to severe herding.

6.3.2.2 Search Costs and Flow-Performance Sensitivity

In a market with frictions, search cost is an important determinant of subsequent fund flows as well as flow-performance sensitivity. When investors try to screen and identify the best investment opportunity from a vast universe of mutual funds available to them, it is necessary to expend effort in gathering information about the possible options. Although internal traits such as client type or investor characteristics may result in different level of costs to different individuals, external factors also impact individual's fund allocation. These external factors may include fund family size, star affiliation, expenses on marketing and advertising, and media attention. (Sirri and Tufano, 1998; Massa, 2003; Jennifer Huang, Wei and Yan, 2007; Zhao, 2008).

Table 6.6 reports the results of Fama-Macbeth Regression of subsequent fund flows on performance ranks based on alternative measures and interaction term between performance ranks and a dummy variable, which equals one if the logarithm of lagged fund family size is larger than the median logarithm of lagged fund family size, and zero otherwise. We observe that bottom performers from a larger fund family enjoy a stronger flow-performance relationship while fund flows are less sensitive to past superior performance of top performers from a larger fund family for both international and domestic funds. Underperformed mutual funds affiliated with larger fund families might benefit from the brand recognition of fund families as well as more marketing efforts from the fund families. Besides, larger fund families provide investors with a greater number of investment objectives and a wider range of products and sometimes even lower switch cost when investors reallocate their asset by switching within the fund family. Hence, mutual funds affiliated with larger parent complexes attract fund inflows even with inferior performance. The increased sensitivity of flow-performance relationship for bottom performers in large fund family then lead to a decline in fund inflows to top performers.

Table 6.7 displays the results of Fama-Macbeth Regression of subsequent fund flows on performance ranks based on alternative measures and interaction term between performance ranks and a dummy variable, which equals one if a fund's total fee is higher than the median for its IMA Sector (domestic funds) or Lipper Scheme (international funds), and zero otherwise. It is widely documented that 12b-1 fee[42], front-end load and back-end load are most relevant to marketing and search cost. Therefore, plenty of literature uses 12b-1 fee or total expense ratio plus one seventh of front-end load as proxy for marketing cost (e.g. Sirri and Tufano, 1998; Jennifer Huang, Wei and Yan, 2007; Navone, Pagani and Pantos, 2012). However, we have no access to 12b-1 fee and back-end loads, therefore we compute total expense as annual management charge plus geometric annual average of front-end load amortized over five years as a measure of marketing cost due to the data limitations. We fail to find significant and robust increase or decrease in flow-performance sensitivity for international funds with higher total fees. It might be due to the incomplete data on international fund fees though fund fees are found to have no impact on fund flows and flow-performance sensitivity for international mutual funds in existing literature (e.g. Zhao, 2008; Kaushik, 2012). We find significant positive effect of total fees on flow-performance sensitivity for domestic funds in the mid three quintiles. Fund flows to domestic moderately good performers with higher total fees are more sensitive to past performance. This finding is consistent with Jennifer Huang, Wei and Yan (2007) and suggests that for UK domestic equity mutual funds, more efforts on marketing and distribution can lower search costs and improve investor recognition for domestic funds with moderate performance.

[42] 12b-1 fees are charged against the assets of mutual funds for fund advertising and marketing as well as distribution services provided by intermediaries.

Table 6. 6: The Effect of Fund Family Size on Flow-Performance Sensitivity

	UK-based International						UK Domestic					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	RR_12M	RR_36M	R361F_AR	R364F_AR	1F_36M	4F_36M	RR_12M	RR_36M	R361F_AR	R364F_AR	1F_36M	4F_36M
OBJFlow t-1	0.780***	0.686***	0.714***	0.711***	0.675***	0.703***	0.949***	0.786**	1.063***	1.100***	2.407*	3.599**
	(0.121)	(0.097)	(0.163)	(0.154)	(0.109)	(0.119)	(0.276)	(0.384)	(0.2783)	(0.2874)	(1.426)	(1.392)
TNA t-1	-0.015***	-0.013***	-0.009***	-0.009***	-0.012***	-0.012***	-0.009***	-0.0082***	-0.0048***	-0.0044***	-0.0077***	-0.0075***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.0015)	(0.0013)	(0.0012)	(0.0013)	(0.0014)	(0.0014)
Expense t-1	-2.874	-3.042	-1.191	-2.008	-1.064	-1.742	0.163	-0.0575	-0.3374	0.1745	0.199	1.343
	(2.292)	(2.747)	(1.911)	(1.974)	(2.145)	(2.136)	(1.848)	(2.288)	(2.4354)	(2.5137)	(2.286)	(2.417)
AGE t-1	-0.021***	-0.004	-0.008*	-0.008*	-0.005	-0.005	-0.0189***	-0.0059***	-0.0084***	-0.0085***	-0.0067***	-0.0068***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.0020)	(0.0017)	(0.0023)	(0.0023)	(0.0017)	(0.0016)
Family Size t-1	0.001	0.000	0.004	0.004*	0.001	0.002	-0.0011	0.0013	0.0020**	0.0016	0.0013	0.0009
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.0012)	(0.0013)	(0.0010)	(0.0011)	(0.0014)	(0.0017)
FX t-1	0.002	0.005	0.013	0.011	0.003	0.003						
	(0.007)	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)						
Correlation t-1	-0.011	-0.025	-0.008	0.004	-0.044	-0.057						
	(0.028)	(0.030)	(0.033)	(0.035)	(0.039)	(0.044)						
Risk, -1 to -36		0.279			0.318	0.116		-0.644**			-0.402	-0.212
		(0.268)			(0.314)	(0.325)		(0.302)			(0.405)	(0.417)
Risk, -1 to -12	0.389		0.380	0.419			-0.745		-0.4357	-0.1739		
	(0.363)		(0.317)	(0.327)			(0.517)		(0.4928)	(0.5608)		
Low, -1 to -36		0.279			0.115**	0.215***		0.0455			0.0444	0.117**

	(0.268)			(0.049)	(0.052)	(0.0630)	(0.0520)	(0.0488)
Mid, -1 to -36	0.063			0.079***	0.035*	0.0671***	0.0684***	0.0614***
	(0.063)			(0.019)	(0.020)	(0.0130)	(0.0114)	(0.0117)
High, -1 to -36	0.067***			0.265***	0.307***	0.673***	0.562***	0.421***
	(0.019)			(0.077)	(0.078)	(0.131)	(0.130)	(0.113)
Low, -1 to -36	0.456***			0.074	0.042	0.0369	0.0372	0.0231
*D_FamilySize t-1	(0.089)			(0.050)	(0.062)	(0.0312)	(0.0361)	(0.0392)
Mid, -1 to -36	0.087*			-0.016	0.008	0.0068	0.0032	0.0017
*D_FamilySize t-1	(0.046)			(0.019)	(0.025)	(0.0130)	(0.0135)	(0.0131)
High, -1 to -36	-0.004			-0.155**	-0.157*	-0.361***	-0.270**	-0.0873
*D_FamilySize t-1	(0.018)			(0.073)	(0.081)	(0.108)	(0.117)	(0.114)
Low, -1 to -12	0.120*	0.145**	0.078		0.122***	0.1330***	0.1293***	
	(0.060)	(0.068)	(0.065)		(0.0360)	(0.0474)	(0.0409)	
Mid, -1 to -12	0.053***	0.040**	0.045***		0.0970***	0.0542***	0.0629***	
	(0.014)	(0.019)	(0.014)		(0.0123)	(0.0161)	(0.0137)	
High, -1 to -12	0.359***	0.302**	0.307**		0.553***	0.5107***	0.3343***	
	(0.098)	(0.114)	(0.126)		(0.101)	(0.1231)	(0.1106)	
Low, -1 to -12	0.051	0.018	0.022		0.150***	0.0446	0.0392	
*D_FamilySize t-1	(0.049)	(0.052)	(0.048)		(0.0321)	(0.0290)	(0.0338)	
Mid, -25 to -36	-0.008	-0.015	-0.019		-0.0353**	-0.0155	-0.0248	
*D_FamilySize t-1	(0.019)	(0.023)	(0.020)		(0.0157)	(0.0147)	(0.0175)	
High, -25 to -36	0.009	-0.144	-0.156		-0.288***	-0.1843	-0.0859	
*D_FamilySize t-1	(0.127)	(0.106)	(0.118)		(0.102)	(0.1204)	(0.1011)	

Constant	0.0647**	0.0209	-0.0173	-0.0039	-0.0141	-0.0092	0.0527**	0.0303	-0.0011	-0.0088	0.0272	0.0265
	(0.0303)	(0.0243)	(0.0243)	(0.0226)	(0.0222)	(0.0221)	(0.0263)	(0.0237)	(0.0342)	(0.0379)	(0.0373)	(0.0389)
Observations	16,863	13,193	12,621	12,621	14,238	14,238	20,269	16,663	14,672	14,672	16,663	16,663
R-squared	0.143	0.124	0.1102	0.1127	0.114	0.113	0.116	0.100	0.1043	0.0921	0.096	0.084

Table 6.6 reports the effect of fund family size on the flow-performance sensitivity for UK domestic and international equity mutual funds respectively. Each quarter, a piecewise linear regression is performed by regress quarterly percentage flows on performance ranks as well as its interaction with a fund family size dummy. The fund family size dummy equals 1 if the fund family size that a fund belongs to is larger than the median fund family size of all other funds at $t-1$, and otherwise, equals to 0. We include various measures of the fractional performance rank ($RANK_t$), which ranges from 0 to 1, of fund i in the preceding years as independent variables. The ranks ($RANK_t$) are calculated in the same way as in Table 6.5. The measures of past performance include prior 12-month net returns (R_12M), prior 36-month net returns (R_36M), annual abnormal return from single factor model with time-varying factor loadings estimated over preceding 36 months (R361F_AR) where abnormal returns are defined as the difference between realized monthly net returns of that fund and the expected returns estimated from factor models, annual abnormal return from Carhart four-factor model with time-varying factor loadings estimated over the prior 36 months (F364F_AR), annualized alpha estimates from single factor model over the preceding three years (1F_36M) and annualized alpha estimates from Carhart four-factor model over the preceding three years (4F_36M). These regressions are run quarter-by-quarter following Fama and MacBeth (1973). Time-series averaged coefficients and the Newey-West robust standard errors (in parentheses) are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 6. 7: The Effect of Total Expense on Flow-Performance Sensitivity

	UK-based International						UK Domestic					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	RR_12M	RR_36M	R361F_AR	R364F_AR	1F_36M	4F_36M	RR_12M	RR_36M	R361F_AR	R364F_AR	1F_36M	4F_36M
OBJFlow t-1	0.762***	0.700***	0.682***	0.710***	0.685***	0.677***	0.939***	0.772*	1.135***	1.177***	2.592*	4.335**
	(0.119)	(0.091)	(0.163)	(0.160)	(0.095)	(0.095)	(0.292)	(0.402)	(0.2921)	(0.2875)	(1.455)	(1.796)
TNA t-1	-0.016***	-0.014***	-0.009***	-0.008***	-0.012***	-0.012***	-0.0089***	-0.0083***	-0.0049***	-0.0046***	-0.0079***	-0.0076***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.0014)	(0.0013)	(0.0013)	(0.0013)	(0.0014)	(0.00141)
Expense t-1	-1.068	-1.812	-0.439	-0.906	-0.720	-1.283	-1.258	-2.698	-1.9643	-2.0072	-2.177	-1.227
	(3.480)	(2.893)	(1.820)	(1.956)	(2.286)	(2.124)	(1.878)	(2.091)	(1.8076)	(1.7597)	(2.072)	(2.089)
AGE t-1	-0.021***	-0.004	-0.008**	-0.008**	-0.005	-0.006	-0.0186***	-0.0048**	-0.0077***	-0.0078***	-0.0055***	-0.0065***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.0018)	(0.0019)	(0.0025)	(0.0024)	(0.0018)	(0.0016)
Family Size t-1	0.003	0.002	0.002*	0.003**	0.003*	0.003*	0.0011	0.0021**	0.0013	0.0007	0.0021**	0.0015
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.0011)	(0.0010)	(0.0010)	(0.0011)	(0.0010)	(0.0011)
FX t-1	-0.002	0.006	0.008	0.008	0.001	0.001						
	(0.007)	(0.010)	(0.010)	(0.009)	(0.010)	(0.009)						
Correlation t-1	-0.016	-0.038	0.001	-0.002	-0.045	-0.052						
	(0.028)	(0.030)	(0.025)	(0.034)	(0.036)	(0.041)						
Risk, -1 to -36		0.268			0.302	0.159		-0.626**			-0.359	-0.161
		(0.265)			(0.328)	(0.321)		(0.292)			(0.400)	(0.401)
Risk, -1 to -12	0.334		0.369	0.357			-0.710		-0.441	-0.225		
	(0.356)		(0.326)	(0.355)			(0.526)		(0.4801)	(0.5501)		
Low, -1 to -36		0.268			0.160***	0.234***		0.0511			0.0563	0.120***

	(0.265)			(0.050)	(0.043)	(0.0586)	(0.0399)	(0.0407)
Mid, -1 to -36	0.101			0.069***	0.037***	0.0589***	0.0603***	0.0503***
	(0.063)			(0.012)	(0.013)	(0.0120)	(0.0096)	(0.0069)
High, -1 to -36	0.071***			0.194***	0.238***	0.423***	0.369***	0.351***
	(0.009)			(0.052)	(0.058)	(0.0985)	(0.102)	(0.0891)
Low, -1 to -36	0.316***			-0.043	-0.043	-0.0142	-0.0178	-0.0264
*D_Expense t-1	(0.053)			(0.046)	(0.057)	(0.0257)	(0.0362)	(0.0366)
Mid, -1 to -36	-0.049			0.017	0.011	0.0460**	0.0446*	0.0524**
*D_Expense t-1	(0.062)			(0.031)	(0.031)	(0.0196)	(0.0229)	(0.0212)
High, -1 to -36	0.020			0.004	0.018	0.0379	-0.0003	-0.0418
*D_Expense t-1	(0.037)			(0.135)	(0.132)	(0.102)	(0.0900)	(0.0856)

Low, -1 to -12	0.138*	0.166***	0.123*	0.205***	0.1683***	0.1490***
	(0.070)	(0.056)	(0.061)	(0.0333)	(0.0454)	(0.0407)
Mid, -1 to -12	0.060***	0.034***	0.026**	0.0743***	0.0286*	0.0360***
	(0.014)	(0.011)	(0.012)	(0.0115)	(0.0146)	(0.0104)
High, -1 to -12	0.377***	0.195***	0.190***	0.328***	0.4180***	0.3137***
	(0.069)	(0.064)	(0.069)	(0.0772)	(0.0937)	(0.0755)
Low, -1 to -12	-0.039	-0.051	-0.123***	-0.0315	-0.0537**	-0.0386
*D_Expense t-1	(0.050)	(0.034)	(0.040)	(0.0333)	(0.0257)	(0.0360)
Mid, -25 to -36	0.003	0.008	0.049*	0.0212	0.0507**	0.0604***
*D_Expense t-1	(0.025)	(0.024)	(0.026)	(0.0207)	(0.0213)	(0.0155)
High, -25 to -36	-0.001	0.095	0.097	0.243*	-0.0057	-0.1031
*D_Expense t-1	(0.123)	(0.130)	(0.124)	(0.130)	(0.0921)	(0.0931)

Constant	0.065*	0.041	-0.009	0.007	0.028	0.038	0.0441	0.0388*	0.0121	0.0120	0.0363	0.0411
	(0.038)	(0.045)	(0.034)	(0.043)	(0.053)	(0.055)	(0.0275)	(0.0230)	(0.0328)	(0.0352)	(0.0379)	(0.0425)
Observations	16,847	13,193	12,621	12,621	14,238	14,238	20,269	16,663	14,672	14,672	16,663	16,663
R-squared	0.146	0.126	0.110	0.112	0.118	0.115	0.113	0.096	0.0100	0.089	0.091	0.079

Table 6.7 reports the effect of total expenses on the flow-performance sensitivity for UK domestic and international equity mutual funds respectively. Each quarter, a piecewise linear regression is performed by regress quarterly percentage flows on performance ranks as well as its interaction with a total expense dummy. The total expense is calculated as the sum of annual management fee plus geometric average of initial loads that amortized over five years. The total dummy equals 1 if a fund's total expense is higher than the median total expenses of all other funds at $t-1$, and otherwise, equals to 0. The ranks ($RANK_t$) are calculated in the same way as in Table 6.5. The measures of past performance include prior 12-month net returns (R_12M), prior 36-month net returns (R_36M), annual abnormal return from single factor model with time-varying factor loadings estimated over preceding 36 months (R361F_AR) where abnormal returns are defined as the difference between realized monthly net returns of that fund and the expected returns estimated from factor models, annual abnormal return from Carhart four-factor model with time-varying factor loadings estimated over the prior 36 months (F364F_AR), annualized alpha estimates from single factor model over the preceding three years (1F_36M) and annualized alpha estimates from Carhart four-factor model over the preceding three years (4F_36M). These regressions are run quarter-by-quarter following Fama and MacBeth (1973). Time-series averaged coefficients and the Newey-West robust standard errors (in parentheses) are reported. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

6.4 Conclusion

In this chapter, we have focused on examining the reaction of investor fund flows to past performance and analyzing the impact of total expense, fund family size on the sensitivity of flow-performance relationship for UK domestic and international equity mutual funds. We aimed at spotting any difference between the behaviors of UK domestic fund investors and UK-based international fund investors and obtaining some inferences on how various factors related to fund characteristics affect retail investor's decision-making. We have documented empirical differences in flow-performance relationship between UK domestic and international equity mutual funds. International fund investors are more likely to base their investment decisions on risk-adjusted performance than UK domestic fund investors though lagged net returns are also important determinants of future fund flows. However, after 2008 financial crisis, UK domestic investor fund flows are more sensitive to Jensen's alphas than raw returns. International fund investors have been found to update the performance information in a timelier manner than domestic fund investors. Fund flows to international funds are most sensitive to the most recent risk-adjusted performance. In contrast, domestic fund investors react to past performance with a six-month lag. We compared the importance of the discrete event of beating a market benchmark to domestic and international fund investors. The results suggest that both international and domestic fund investors might interpret beating a benchmark as a validation of superior managerial skills. While beating FTSE All World appears to be important to international fund investors, beating a domestic market index does not help attract future fund flows. It is consistent with the existing evidence on international fund investor's preference over international equity funds that are less correlated with domestic markets to maximize the diversification benefits.

In order to provide empirical evidence for Berk and Green (2004)'s prediction, we examined the convexity in flow-performance relationship following the piecewise linear regression approach proposed by Sirri and Tufano (1998). We find a convex flow-performance relationship for both international and domestic equity mutual funds. Retail investors are observed to direct their money disproportionately more to the best-performing funds in the prior period but fail to punish those worst performing funds by withdrawing money out. Besides, money inflows to international funds appear to be less sensitive to the performance of past winners than fund inflows to domestic funds, which means domestic fund investors

show a more aggressive return chasing behavior for the top 20% winner funds than their international peers. For the bottom quintile mutual funds, international fund investors appear to be slightly more reluctant to withdraw their money out. These results are important for the analysis of performance persistence in mutual funds in chapter 7. According to Berk and Green (2004), large fund flow acts as the equilibrating mechanism, which can lead to unpredictability in performance when decreasing returns to scale presents. The more convex flow-performance relationship found for the best performing UK domestic unit trusts might lead to lower level of performance persistence in domestic mutual fund performance for the top funds. On the other hand, the failure of punishing worst performing funds might result in performance persistence in the worst performing funds.

The evidence for the impact of factors related to fund fundamentals on the sensitivity of subsequent fund flows to past performance is mostly consistent to existing literature (e.g. Sirri and Tufano, 1998; Jennifer Huang, Wei and Yan, 2004, 2007) and can be explained by investor characteristics and search and participation costs. We find that fund family size and total fees as material measures for search costs can affect the flow-performance sensitivity for UK domestic and international mutual funds. The impact concentrate on funds in certain performance ranges rather than all performance ranges.

Our empirical findings have several implications. The evidence shows that the sensitivity of investor fund flows to past performance, fund fees, overall fund risk changes over time. If fund managers learn about the changing needs of investors and the state dependent investor behaviour, they might be able to improve their service and attract more clients. The convexity of the flow-performance relationship can create incentive for fund managers to adopt risk-taking behaviour (Keith C Brown, Harlow and Starks, 1996; Chevalier and Ellison, 1997). Fund managers who face a more convex flow-performance relationship might take more risk as they can gain higher reward if they achieve superior performance but lose less if they perform poorly (Ferreira et al., 2012). Even there is some evidence that mutual fund investors prefer less risky funds, it may not mitigate fund managers' risk-taking behaviour. The findings with respect to search costs suggest that domestic fund managers who can only achieve moderate performance can boost fund flows by exerting more effort on marketing.

The observed autocorrelation in investor fund flows for both domestic and international funds might be attributed to a tendency that both domestic and international investors direct money

to the same funds year after year without re-evaluate the investment (Del Guercio and Tkac, 2002). From a regulator's perspective, it is necessary to regulate the advertising and marketing of mutual fund performance by requiring fund managers to caution investors against relying heavily on performance without risk adjustment and short term superior performance.

Table 6. 8: Summary of Hypotheses Tested and Main Results

Hypotheses Tested	Results
H6: Risk-adjusted past returns have a greater impact on fund flows into both UK domestic and international funds than raw returns.	Flow-performance relationship is similar for international and domestic funds when flows regressed on lagged net returns only. When Jensen's alpha is incorporated, international investors are more sensitive to risk-adjusted returns than domestic investors, while fund flows are more sensitive to performance measured on a risk-adjusted basis for both types of funds.
H7: Fund flows into UK international mutual funds are more sensitive to risk-adjusted returns than fund flows into domestic mutual funds.	
H8: The sensitivity of fund flows to risk-adjusted returns is relatively stable around the 2008 financial crisis for international mutual funds but not for domestic mutual funds.	After 2008 financial crisis, UK domestic investor fund flows are more sensitive to Jensen's alphas than raw returns while the sensitivity of fund flows to risk-adjusted performance is stable for international fund investors.
H9: For international funds, fund flows are more sensitive to recent risk-adjusted performance while for domestic funds, flows have a delayed response to past performance.	International investors respond to the recent quarter's abnormal returns while domestic investors react to past performance with a longer lag.
H10: For both UK domestic and international funds, the discrete event of beating a market benchmark attracts fund inflows.	Beating FTSE All World index is important for international fund flows while beating FTSE All Shares index attracts domestic fund flows.
H11: Investors invest more in top performers but are reluctant to withdraw money from the worst performing funds.	Convexity of flow-performance relationship for both domestic and international funds is robust to alternative performance measures.
H12: The flow-performance relationship is more convex for the best past performing UK domestic mutual funds than the best past performing international equity mutual funds.	Convex flow-performance relationship with domestic investors having more aggressive return chasing behaviour than international investors with winning funds has been observed.
H13: The convexity in the flow-performance relationship is affected by search costs for both UK domestics and international equity mutual funds.	Bottom performers from a larger fund family enjoy a stronger flow-fund performance relationship for both domestic and international funds. Significant positive effect of total fees on flow-performance sensitivity for domestic funds in mid three quintiles has been observed. Fund flows to domestic moderate performers with higher total fees are more sensitive to past performance. International investors do not respond to higher fees.

Chapter 7 Fund Performance Persistence

7.1 Introduction and Hypotheses

As we have already discussed in Chapter 6, one reason for investors to disproportionately direct money into the top-performing actively managed mutual funds is that they judge managerial skill from past performance and expect that the positive abnormal returns will persist into the future. This smart money effect, which asserts that investors are smart enough to channel money to active mutual funds with subsequent superior performance was examined and evidenced by Gruber (1996), Zheng (1999) and Wermers (2003) but questioned by Sapp and Tiwari (2004) who found that after controlling for momentum, smart money shows little evidence of superior risk-adjusted returns and investors just happen to benefit from the momentum effect when they naïvely chase recent outperformers. Keswani and Stolin (2008) employed a British sample with exact information on monthly money inflows and outflows to test whether UK institutional and retail investors have superior fund selection ability. Their results confirmed the existence of smart money effect in UK actively managed mutual funds, which could not be explained by fund size, stock return momentum and fund fees. They also reexamined the US data and provided evidence of smart money effect for US active funds in the post-1991 period.

Despite of the findings in favor of performance persistence in actively managed mutual funds, Berk and Green (2004) attributed the lack of persistence in mutual fund performance, which has been documented in existing literature to decreasing returns to scale from fund flows, which are the equilibrating mechanism. When mutual funds grow too large, the information gathering capacities of fund managers will be spread too thinly and the trading activities will have a greater price impact on the underlying assets and incur higher costs. Nevertheless, Ferreira et al. (2013b) pointed out that the assumption of decreasing returns to scale in Berk and Green (2004) might not be universally applicable as it closely related to the development level of mutual fund industry. However, even in a country with its mutual fund industry as developed as in US, individual funds may still not experience diseconomies of scale when they are not large enough to exert price impact on the underlying asset markets or fund fixed costs are spread across the large money pool under management. At the fund level, it is also possible that some fastest-growing funds may acquire extra resources from their fund

families, which is expected to create some "star" funds to attract more investment (Ferreira et al., 2013b).

While there is no consensus on whether there is persist pattern in mutual fund performance in existing literature that mainly concentrate on US domestic mutual funds, evidence of persistence in UK domestic equity unit trusts is also mixed (e.g. Fletcher, 1997; Blake and Timmermann, 1998; Allen and Tan, 1999; Quigley and Sinquefield, 2000; Fletcher and Forbes, 2002; Cuthbertson, Nitzsche and O'Sullivan, 2008, 2010b). The conflicting results stem from analysis of different samples of UK domestic mutual funds using alternative fund performance measures and methods for testing performance persistence over different holding periods. Some underlying factors that were recognized to drive persistence in US studies are also examined for UK mutual funds including fund type, management and transaction expenses, turnover ratio and survivorship bias. Compared to domestic mutual funds, international mutual funds have drawn less attention in studies of performance persistence. Busse, Goyal and Wahal (2013) applied recursive portfolio approach proposed by Carhart (1997) to examine the persistence in US-based international mutual fund performance. They found some evidence of short-term performance persistence in global funds but little evidence of performance persistence in developed and emerging market funds. Consistent with Carhart (1997), the momentum effect explained most of the persistent patterns. Vidal-García et al. (2016) conducted a cross-country study to examine short-term persistence in equity mutual fund performance using a sample of daily data on 35 countries over 1990 to 2013. They found evidence of short-term performance persistence, which was robust to alternative performance measures and performance persistence test methodologies. However, the persistent pattern in fund performance was observed to disappear after one year. In the numerous studies on performance persistence in mutual funds, empirical test of Berk and Green (2004) model of fund flows is very limited. Berk and Tonks (2007) examined a large sample of 9,830 US equity mutual funds over 1962 to 2004 and suggested that the long-term performance persistence in the worst performing mutual funds observed by Carhart (1997) can be explained by investors being reluctant to withdraw money from the worst performing funds. Bessler et al. (2010), alternatively, attempted to explain the lack of long-term performance persistence in actively managed mutual funds by fund flows and manager changes. Their results were consistent with Berk and Green (2004)'s prediction as they found that fund flows

and manager changes were important in determining future performance and explaining performance persistence.

Ferreira et al. (2013b) carried out a cross-country study on performance persistence in actively managed equity mutual funds using a sample of 27 countries and documented contrary findings. They found significant performance persistence in most countries, which can be attributed to most fund industries not experiencing decreasing returns to scale and the small economic magnitude of the impact of fund flows on persistence.

In this chapter, we will empirically test Berk and Green (2004)'s model by examining whether fund flows impact performance persistence in active equity mutual funds. In particular, we compare the performance persistence between UK domestic and international equity mutual funds over different term horizons. The hypotheses that will be tested in this chapter are:

Hypothesis 14: *In comparison to UK-based international equity mutual funds, there is less performance persistence than in the UK domestic equity mutual funds.*

Hypothesis 15: *The best performing mutual funds that experience large net fund inflows will have worse subsequent performance than the best performing mutual funds that experience small net fund inflows. The worst performing mutual funds that experience small net fund inflows will generate better subsequent performance than the worst performing mutual funds that experience large net fund inflows.*

In chapter 5 and chapter 6, we have examined the conditions for Berk and Green (2004) model being fulfilled. In chapter 5, we have found that a small group of UK domestic and international mutual fund managers have superior ability to outperform the benchmark after controlling for stock return momentum, though average underperformance after considering management and operational expenses has been documented for both UK domestic and international equity mutual funds. More importantly, we have confirmed that there is significant evidence of decreasing returns to scale for both UK domestic and international equity mutual funds. With respect to the relationship between fund flows to past performance, we have found that UK domestic fund investors are more sensitive to past outperformance but less reluctant to punish past losers in comparison to international fund investors in chapter 6. In terms of the predictions of Berk and Green (2004), we expect to find less performance persistence in those outperforming funds that experience fund inflows and underperforming

funds that experience outflows. In both cases the lack of persistence will be due to a convex flow-performance relationship and decreasing returns to scale to fund management. In comparison to international unit trusts, we should find less performance persistence in UK domestic unit trusts in accordance with the Berk and Green (2004) where the responsiveness of fund flows to past performance is greater in both the top and the bottom quintile for domestic funds. Therefore, larger fund money inflows to past winners and larger fund flows out of past losers can result in less performance persistence in funds in the top and bottom quintiles. The equilibrating mechanism of fund flows described above can be restricted by time horizons over which the performance persistence is tested as it takes time for fund size to grow large enough to have a price impact on the underlying assets and induce decreasing returns to scale. Due to the limited access to fund size data, we mainly perform empirical test and comparative analysis at the term horizon of 12 months following Bessler et al. (2010), which also allows comparison with existing evidence.

This chapter will be structured as follows. Firstly, we test performance persistence over alternative holding periods for both entire samples of UK domestic and international funds as well as subsamples with difference sector focuses by applying recursive portfolio approach proposed by Carhart (1997) and employed by Berk and Tonks (2007). Secondly, we further examine the impact of fund flows on performance persistence using the recursive portfolio approach conditional on fund flows employed by Bessler et al. (2010) over 12-month holding period for UK domestic and international funds.

7.2 Methodology and Data

7.2.1 Methodology

7.2.1.1 Abnormal Returns

Alternative factor models are employed to calculate abnormal returns as the basis for performance persistence tests in this chapter[43]. Monthly abnormal returns for each fund are computed as the difference between realized monthly net returns of that fund and the expected returns estimated from factor models. The four factor models are employed includes CAPM, Fama and French three-factor model, Carhart four-factor model, and Carhart four-

[43] We will mainly focus on results based on abnormal returns from Carhart four-factor model in section 7.3.

factor model with market timing. The factor loadings are estimated over the entire sample, which means we assume that they remain constant for the entire sample period. This assumption ignores changes in factor loadings over time and may result in look-ahead bias (Gregory and Whittaker, 2007). According to Gregory and Whittaker (2007), the conclusions on performance persistence are influenced by performance measures utilized when funds are ranked on the basis of past performance, which appears to be time varying. Therefore, to address the look-ahead bias and allow the factor loadings to be time variant, following Gregory and Whittaker (2007), we also estimate the time-varying factor loadings based on Carhart four-factor model by running rolling regression over past 24 months and calculate associated abnormal returns for each fund. While most literature uses 36 months as rolling window, we choose to run regression over previous 24 months due to the relatively shorter period our sample covers as well as the incomplete fund size data we have.

7.2.1.2 Performance Persistence Test

We apply performance ranked portfolio test, also known as recursive portfolio approach employed by Carhart (1997) and Berk and Tonks (2007) to empirically test performance persistence. Amongst the three commonly used methodologies to examine performance persistence, which are recursive portfolio approach, contingency tables and cross-sectional regressions of current alphas on past alphas, recursive portfolio approach is advocated by Carpenter and Lynch (1999) as the most powerful test for performance persistence especially in the presence of survivorship bias. Section 4.1.3 gives the details of performance persistence test we use in this thesis.

7.2.1.3 Fund Flows

Both net percentage flows and absolute flows are utilized in the empirical test of Berk and Green (2004) model of fund flows. To avoid extreme fund flows resulting from mergers to affect our results, we winsorize net percentage flows and absolute flows at the 0.75th and 99.25th percentage for UK domestic and international mutual funds. The definition of both relative and absolute measures of fund flows has been discussed in Chapter 4.

7.2.1.4 Empirical Tests of the Equilibrating Mechanism of Fund Flows

To empirically test the prediction of Berk and Green (2004) on the impact of fund flows on performance persistence, following Bessler et al. (2010), after ranking funds into quintiles based on their abnormal returns from Carhart four-factor model at the end of each formation

period, we further sort funds based on whether they receive higher or lower inflows than the median fund inflows of all other funds classified in the quintile. Then we compute the monthly equally weighted average returns for four portfolios resulted from the double sorting procedure in the formation period, which are top quintile performers with higher than median flows (5 high), top quintile performers with lower than median flows (5 low), bottom quintile performers with higher than median flows (1 high) and bottom quintile performers with lower than median flows (1 low) in the subsequent evaluation period and measure the performance using Carhart four-factor model. We use both absolute fund flows and relative fund flows in our analysis for robustness and report alphas computed from Carhart four-factor Model with significance indicated by "stars". We run the tests over twelve-month ranking and evaluation periods. While Bessler et al. (2010) are interested in the combined effect of fund flows and manager changes on performance persistence, we focus solely on testing whether fund flows are important determinants on future performance of mutual funds. We sort funds into quintiles instead of deciles due to the relatively smaller sample size compared to Bessler et al. (2010). With respect to the length of holding period examined, although we would like to extend our research with longer formation and evaluation periods, for instance, thirty-six months, we are unable to conduct the analysis because of incomplete information on fund size and fund flows. In addition, as suggested by existing literature, performance persistence for the best-performing mutual funds generally disappears after 12 months while underperformance persists in longer term Therefore, most of the earlier literature that aims at validating the existence of smart money effect or empirically test Berk and Green (2004) model set the holding period less than one year. As to a formation and evaluation period as short as one month, Del Guercio and Tkac (2002) point out that monthly fund flows are most probably due to investor's cash needs rather than a reflection of return-chasing behavior.

7.2.2 Data

The sample we employ for this chapter is the same sample as we use in Chapter 5. Details of sample construction and description have been discussed in Chapter 4.

7.3 Empirical Results

7.3.1 Performance Persistence

Table 7.1 reports performance persistence test for UK domestic and international funds as well as funds in different subcategories over alternative ranking and evaluation periods when rankings are based on abnormal returns from Carhart four-factor model. The fourth, fifth and sixth column lists alpha estimates from Carhart four-factor model for top quintile portfolio, bottom quintile portfolio and a zero-cost portfolio constructed by taking a long position in the top quintile and a short position in the bottom quintile respectively. The alpha estimates of the zero-cost portfolios formed by the entire sample of domestic funds are significantly positive at the very short term horizon of one month and the longest term horizon of 36 months. Over one month ranking and evaluation period, the alpha estimate of top quintile UK domestic equity mutual funds is significantly different from zero with a value of 0.19% while the bottom quintile reveals persistence with a significant negative alpha estimate of -0.17%. At the longest term horizon of 36 months, the outperformance of UK domestic funds in the top quintile in previous period does not extend to the following period while the performance of the worst performing domestic funds are persistent with a significant alpha of -0.15%. We fail to find significant performance persistence in UK domestic funds across the intermediate horizons. This pattern also applies to UK All Companies funds where alpha estimates are in general less significant compared to that of the UK domestic funds. The observed persistence in performance of UK domestic funds and UK All Companies funds is mainly caused by persistent underperformance of bottom quintile funds, which has also been evidenced in previous literature (e.g. Carhart, 1997; Berk and Tonks, 2007). Nevertheless, we find persistent patterns in performance of UK Equity Income funds and UK Smaller Companies funds at almost all term horizons in terms of significantly positive alpha estimates of the spread-position portfolios that goes long the top quintile funds and goes short the bottom quintile funds (the two exceptions are the four-factor alpha of UK Equity Income funds at one-month horizon and the alpha estimate of UK Smaller Companies funds at twelve-month horizon). Compared to UK domestic funds and UK All Companies funds, UK Equity Income funds and UK Smaller Companies funds show more evidence of performance persistence.

There is some evidence of short-term persistence for the entire sample of international equity funds based on the significant difference in alphas of the top quintile and bottom quintile portfolios. Especially, the highest alpha estimate of the spread-position portfolio appears at six-month horizon with a significant positive value of 0.5%. However, this persistent pattern disappears in medium and long term. Although significant performance persistence is observed for the best performing international funds at all term horizons, which is believed to be the main cause for short-term persistence in performance, there is no significant evidence of persistence based on alpha estimates of the top minus bottom portfolios at 12-month and 36-month horizons. We find no persist patterns among worst performing international equity mutual funds across almost all holding periods examined. The lack of performance persistence amongst the worst performing international funds at the short term might be due to the potential survivorship bias incurred in sample construction process. Since our international sample fails to include those short-lived international equity mutual funds that was established and also terminated during 2008 to 2014, we are unable to capture persistent patterns of those underperformed international funds at the short term. In contrast, the top quintile portfolio shows strong persistence in performance at 1% significance level with an alpha estimate of 0.58% over 6 months and weak performance persistence at 10% significance level over the other four ranking and evaluation periods. As we mentioned in chapter 4, the risk factors we use in alternative performance measurement models are constructed for international funds mainly investing in developed countries and region markets (Fama and French, 2012). Therefore, we further study the sample of international funds with investment mainly made in developed countries.

For developed market funds, there is little evidence of performance persistence at horizons longer than one-month. The winner funds exhibit more significant persistence than loser funds at one-month, six-month and twelve-month horizons while the poor performance of bottom quintile developed market funds reverses in the subsequent evaluation periods with positive, though insignificant four-factor alphas at all term horizons examined. Globally diversified funds, on the other hand, show more evidence of persistence based on alpha estimates of spread-position portfolios at almost all horizons examined. It is worth noting that at the longest term horizon of 36 months, the persistence in performance is largely due to

continued underperformance of bottom quintile funds rather than persistent patterns in performance of past winner funds, which holds for 12-month holding period. The evidence of performance persistence for regionally focused funds is only significant at short term horizons in terms of the performance of the zero-cost portfolios. As shown in Table 7.1, there is strong evidence of persistent patterns for the best performing regionally focused funds at all term horizons though the alpha estimates of the bottom quintile regionally focused funds reveal insignificant reversal in performance at the very short and the longest term horizons. It appears that the persistence in performance for the entire sample of international funds is significantly affected by the persistent pattern of regional focused funds. Regional focused funds include funds that mainly invest in certain developed countries, such as United States of America and Australia or areas such as Europe and emerging market funds such as Great China funds and South America funds. As we discussed before, the risk factors we used in performance measurement model are constructed primarily for developed countries, which implies that they might have much less explanatory power over the performance of emerging market funds. Therefore, there are two possible implications of our results. Firstly, regional focused funds especially those emerging market funds do show strong persistence in performance especially the best performing funds. Alternatively, the risk factors for developed countries cannot fully capture the cross-sectional variation in emerging market fund returns and therefore, resulting in spurious persistence in performance especially for those winner funds. In contrast to Busse, Goyal and Wahal (2013) who concluded that the performance persistence of US-based retail international equity mutual funds is largely due to the continued poor performance of the bottom quintile funds while the winner funds only show short-term performance persistence, we find the opposite. When we judge the persistence in performance by the alpha estimates of the spread-position portfolios, there is little evidence of performance persistence for both international and developed market funds beyond 6 months, and more importantly, it seems that the short term persistent patterns result from persistent superior performance of winner funds rather than continued underperformance of those bottom funds.

Our results are robust to alternative factor models employed. In general, short-term persistence in performance disappears after one month for UK domestic equity mutual funds

and after six months for international equity mutual funds. The performance predictability in the worst performing domestic funds in the long term is consistent with Carhart (1997) and Berk and Tonks (2007) while the persistent outperformance of the best performing international funds might be explained by the equilibrating mechanism of fund flows according to Berk and Green (2004). For international funds, we have previously found relatively less sensitive response of fund inflows to past outperformance in Chapter 6, which means capital provision is comparatively less competitive in international funds than in domestic funds. Therefore, it appears that only in the longer term will past winner funds grow large enough to eliminate all abnormal returns, making short-term performance predictable. In addition, the Carhart four-factor model, which incorporates momentum into benchmark can reduce the alpha estimates and explains away much of the performance persistence documented in the previous literature (e.g. Busse, Goyal and Wahal, 2013). In unreported analysis, we also examine the performance persistence of UK domestic and international equity mutual funds before and after 2008 financial crisis using two subsamples: pre-2008 and post-2008[44]. The results reveal that 2008 financial crisis has little impact on performance persistence of UK domestic and international equity unit trusts.

Table 7.2 shows the performance ranked portfolio tests based on rolling abnormal returns from Carhart four-factor model. For the entire sample of UK domestic funds and domestic funds in the three subcategories, there is less evidence of performance persistence when time-varying factor loadings are utilized to estimate abnormal returns. In contrast to the results based on static factor models, there is little evidence of performance persistence for UK domestic and UK All Companies funds at the short term horizon of one month in terms of the alpha estimates of the spread-position portfolios, which are insignificantly different from zero. At the long term horizon of three years, the evidence of persistence is much weaker based on abnormal returns from rolling four-factor model compared to the evidence shown in Table 7.1. The risk-adjusted performance of spread-position portfolio suggests that the performance of UK Equity Income funds only persist in short term, less than 12 months while we find little evidence of persistence in the performance of UK Smaller Companies funds. For international equity mutual funds, the results based on abnormal returns from rolling Carhart four-factor model are consistent with the findings based on static factor models.

[44] The subsamples are identical to the subsamples we employed in Chapter 6.

Table 7. 1: Performance Ranked Portfolio Test Based on Carhart Four Factor Abnormal Returns

Ranking and Evaluation Period	Types of Mutual Funds & Sub Categories	No. periods	Top Quintile	Bottom Quintile	Difference
1-month	UK Domestic	206	0.0019**	-0.0017*	0.0036***
	UK All Companies	206	0.0008	-0.0013*	0.0022**
	UK Equity Income	206	0.0000	-0.0001	0.0001
	UK Smaller Companies	206	0.0023	-0.0002	0.0025**
	UK-based International	206	0.0038*	0.0007	0.0031
	Developed Countries	206	0.0030**	0.0004	0.0026**
	Globally Diversified	206	0.0006	-0.0002	0.0007
	Regionally Focused	206	0.0054**	0.0030	0.0024
3-month	UK Domestic	204	0.0008	-0.0006	0.0014
	UK All Companies	204	-0.0000	-0.0006	0.0005
	UK Equity Income	204	0.0006	-0.0009	0.0016***
	UK Smaller Companies	204	0.0028*	-0.0015	0.0043***
	UK-based International	204	0.0037*	-0.0000	0.0037*
	Developed Countries	204	0.0012	0.0015	-0.0004
	Globally Diversified	204	0.0009	-0.0010	0.0018**
	Regionally Focused	204	0.0059**	0.0023	0.0036*
6-month	UK Domestic	201	-0.0009	0.0005	-0.0014
	UK All Companies	201	-0.0006	-0.0004	-0.0002
	UK Equity Income	201	0.0008	-0.0007	0.0015***
	UK Smaller Companies	201	0.0016	-0.0009	0.0025**
	UK-based International	201	0.0057***	0.0007	0.0050***
	Developed Countries	201	0.0025*	0.0011	0.0014
	Globally Diversified	201	0.0006	-0.0007	0.0013
	Regionally Focused	201	0.0079***	0.0027	0.0052*
12-month	UK Domestic	195	-0.0006	0.0004	-0.0011
	UK All Companies	195	-0.0005	-0.0007	0.0002
	UK Equity Income	195	0.0013	-0.0013	0.0026***
	UK Smaller Companies	195	0.0008	0.0004	0.0003
	UK-based International	195	0.0042**	0.0026	0.0016
	Developed Countries	195	0.0026*	0.0011	0.0016
	Globally Diversified	195	0.0018*	-0.0010	0.0028**

	Regionally Focused	195	0.0065**	0.0044*	0.0020
36-month	UK Domestic	171	0.0004	-0.0015**	0.0019***
	UK All Companies	171	-0.0004	-0.0017**	0.0013**
	UK Equity Income	171	0.0006	-0.0011	0.0016***
	UK Smaller Companies	171	0.0015	-0.0003	0.0018**
	UK-based International	171	0.0039*	0.0020	0.0019
	Developed Countries	171	0.0014	0.0011	0.0003
	Globally Diversified	171	0.0013	-0.0018**	0.0030***
	Regionally Focused	171	0.0058**	0.0035	0.0023

At the end of each ranking period, we rank funds based on their abnormal returns derived from whole sample regressions using Carhart four-factor model over the ranking period, and then divide them into five equally weighted portfolios. In the subsequent evaluation period, we calculate the monthly equally weighted portfolio return of the top and the bottom quintile portfolios as well as the difference in monthly average returns between the top and the bottom quintile portfolios (spread-position portfolios). We further measure the performance using alternative factor models and report the performance of the top and bottom quintile portfolios as well as the spread-position portfolios (Difference) using Carhart four-factor Model. We test five symmetrical ranking and evaluation periods including one month, three months, six months, twelve months and thirty-six months. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 7. 2: Performance Ranked Portfolio Test Based on Abnormal Returns from Rolling Carhart Four Factor Model

Ranking and Evaluation Period	Types of Mutual Funds & Sub Categories	No. periods	Top Quintile	Bottom Quintile	Difference
1-month	UK Domestic	182	0.0005	-0.0013	0.0017
	UK All Companies	182	-0.0002	-0.0014	0.0012
	UK Equity Income	182	0.0011	0.0006	0.0006
	UK Smaller Companies	182	0.0003	0.0000	0.0002
	UK-based International	182	0.0039**	0.0004	0.0036**
	Developed Countries	182	0.0027*	0.0002	0.0025**
	Globally Diversified	182	0.0009	-0.0001	0.0010
	Regionally Focussed	182	0.0062***	0.0014	0.0048**
3-month	UK Domestic	180	0.0004	-0.0010	0.0014
	UK All Companies	180	-0.0000	-0.0010	0.0010
	UK Equity Income	180	0.0013	-0.0002	0.0014**
	UK Smaller Companies	180	0.0024*	-0.0005	0.0029**
	UK-based International	180	0.0049***	0.0006	0.0043***
	Developed Countries	180	0.0031**	0.0010	0.0021*
	Globally Diversified	180	-0.0003	-0.0010	0.0013**
	Regionally Focussed	180	0.0078***	0.0018	0.0060***
6-month	UK Domestic	177	-0.0014*	0.0003	-0.0017
	UK All Companies	177	-0.0011	-0.0005	-0.0006
	UK Equity Income	177	0.0011	-0.001	0.0020***
	UK Smaller Companies	177	0.0013	0.0005	0.0007
	UK-based International	177	0.0049***	0.0017	0.0032**
	Developed Countries	177	0.0024*	0.0014	0.0010
	Globally Diversified	177	0.0005	-0.0000	0.0005
	Regionally Focussed	177	0.0064***	0.0032	0.0032**
12-month	UK Domestic	171	-0.0004	-0.0009	0.0005
	UK All Companies	171	-0.0005	-0.0014*	0.0010*
	UK Equity Income	171	0.0007	-0.0018**	0.0025***
	UK Smaller Companies	171	0.0009	0.0004	0.0006
	UK-based International	171	0.0032*	0.0014	0.0018
	Developed Countries	171	0.0016	0.0001	0.0015

	Globally Diversified	171	0.0008	-0.0016	0.0024**
	Regionally Focussed	171	0.0055**	0.0037	0.0018
36-month	UK Domestic	147	0.0007	-0.0007	0.0014*
	UK All Companies	147	-0.0005	-0.0009	0.0003
	UK Equity Income	147	0.0001	-0.0003	0.0004
	UK Smaller Companies	147	0.0018	0.0005	0.0013
	UK-based International	147	0.0023	0.0000	0.0023
	Developed Countries	147	0.0011	-0.0003	0.0014
	Globally Diversified	147	0.0005	-0.0013	0.0018
	Regionally Focussed	147	0.0020	0.0008	0.0013

At the end of each ranking period, we rank funds based on their abnormal returns derived from whole sample regressions using Carhart four-factor model with allowance of time-varying coefficients estimated over previous 24 months over the ranking period, and then divide them into five equally weighted portfolios. In the subsequent evaluation period, we calculate the monthly equally weighted portfolio return of the top and the bottom quintile portfolios as well as the difference in monthly average returns between the top and the bottom quintile portfolios (spread-position portfolios). We further measure the performance using alternative factor models and report the performance of the top and bottom quintile portfolios as well as the spread-position portfolios (Difference) using Carhart four-factor Model. We test five symmetrical ranking and evaluation periods including one month, three months, six months, twelve months and thirty-six months. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

7.3.2 Fund Flow and Performance Persistence

Table 7.3 presents results for empirical tests of Berk and Green (2004) of fund flows based on four-factor abnormal returns for both UK domestic and international mutual funds with the formation and evaluation period restricted to twelve months. Measuring fund flows over 12-month term horizon is a common way to mitigate the impact of seasonality in investor's buying and selling decisions as well as the effect of short-term liquidity and cash needs (Del Guercio and Tkac, 2002). Besides, analysis based on one-year holding period also allows comparison between our results and existing evidence as well as provide empirical evidence for our hypothesis.

For UK domestic unit trusts, bottom quintile funds that attract high absolute inflows generate a negative alpha of -0.04% while the performance of loser funds that experience lower absolute inflows reverse in the evaluation period with a positive alpha of 0.07%, though neither of them is significant. According to Berk and Green (2004), underperformed funds that experience fund outflows would allow fund managers to deploy their superior ability without diseconomies of scale and therefore the underperformance will not persistent. On the other hand, underperformed funds that show convex flow-performance relationship, which indicates investors are reluctant to withdraw money to realize loss, will continue to perform poorly. Therefore, we expect to observe a negative alpha estimate for the spread-position portfolio that goes long in the bottom quintile high-inflow subgroup funds (1 high) and shorts bottom quintile low-inflow subgroup funds (1 low) if Berk and Green (2004) model works. The significant negative alpha estimates of the spread-position portfolio that goes long bottom quintile high-inflow subgroup funds and goes short bottom quintile low-inflow subgroup funds is supportive of Berk and Green (2004)'s prediction of fund flows when absolute fund flow is utilized. As for winner funds, we would expect the top quintile funds that experience on average high absolute net inflows will perform worse than the winner funds that attract lower money inflows, as portfolio 5 high will experience highest diseconomies of scale in accordance with Berk and Green (2004). The alpha estimate of top quintile funds that suffer from on average high absolute inflows (5 high) reveals a performance indifferent from zero in evaluation period, with a value of -0.02%, which is 4 basis points higher than the insignificant alpha estimate of top quintile funds that experience low net inflows (5 low). The lack of

performance persistence in the best performing and worst performing funds is consistent with Berk and Green (2004) to some extent when we examine the top and bottom quintiles alone. The spread-position portfolio formed by going long winner funds that attract high net inflows and short those with low net inflows generate a negative risk-adjusted return -0.01%, which is insignificant and indifferent from zero. Therefore, although diseconomies of scale from fund flows is the equilibrating mechanism, which lead to no persistence in the performance of the best performing domestic mutual funds, we cannot confirm that domestic funds that have attracted larger fund inflows significantly underperform those funds that have experienced lower fund inflow.

For international equity mutual funds, the top quintile funds that have experienced large absolute inflows generate a positive though insignificant risk-adjusted return of 0.26% while those winner international funds that have attracted relatively low net absolute inflows reveal significant outperformance in the evaluation period with an alpha estimate of 0.36%. However, the spread portfolio of 5 high – 5 low generates an insignificant abnormal return of -0.11% after adjusting for risk, which is indifferent from zero. The empirical tests based on relative flows offer identical inference for international mutual funds. Therefore, the evidence gained from the best performing international funds is not consistent with Berk and Green (2004)'s prediction as there is persistent pattern in the performance for the winner international funds and those winner funds that attract higher fund inflows do not significantly underperform in the near future. Besides, we find little evidence that the worst performing international funds that suffer from larger fund inflows underperform those loser funds that experience lower fund inflows in the evaluation period. Developed market funds display little evidence of performance persistence in the best performing funds that either experiencing larger or smaller fund inflows. The difference in the alpha estimates between 5 high and 5 low portfolios is insignificantly negative and indifferent from zero, which is consistent with the findings on the entire sample of international funds. The bottom quintile funds, either suffering from large absolute inflows or experiencing low net inflows, show little evidence of persistence in performance. Again, it is in accordance with Berk and Green (2004)' prediction to some extent that the worst performing funds that experience outflows would allow managers to deploy their superior ability without diseconomies of scale and therefore the underperformance will not persistent. Our findings are in general consistent with the evidence

of performance persistence provided in section 7.3.1 when the holding and rebalancing period examined is twelve months.

Table 7. 3: Performance of Funds Based on Past 12-month Four-Factor Abnormal Returns and 12-month Fund Flows

Fund Flow Measurement	Ranking	UK Domestic	UK-based International	Developed Countries
Absolute Flow	5 high	-0.0002	0.0026	0.0013
	5 low	-0.0006	0.0036*	0.0018
	1 high	-0.0004	0.0015	0.0004
	1 low	0.0007	0.0023	0.0013
	5 high-5 low	-0.0001	-0.0011	-0.0005
	1 high-1 low	-0.0008*	-0.0008	-0.0009
Relative Flow	5 high	-0.0005	0.0026	0.0013
	5 low	-0.0004	0.0036*	0.0018
	1 high	-0.0003	0.0017	0.0006
	1 low	0.0007	0.0022	0.0013
	5 high-5 low	-0.0006	-0.0009	-0.0006
	1 high-1 low	-0.0006	-0.0005	-0.0006

Funds are ranked into quintiles based on their abnormal returns from Carhart four-factor model and then sorted based on whether they receive higher or lower inflows than the median fund inflows of all other funds classified in the quintile at the end of each formation period. The monthly equally weighted average returns are computed for four portfolios resulted from the double sorting procedure in the formation period, which are top quintile performers with higher than median flows (5 high), top quintile performers with lower than median flows (5 low), bottom quintile performers with higher than median flows (1 high) and bottom quintile performers with lower than median flows (1 low) as well as two spread-position portfolios: 5 high – 5 low and 1 high – 1 low in the subsequent evaluation period. The performance is measured using Carhart four-factor model and then reported. We use both absolute fund flows and relative fund flows in our analysis for robustness. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 7.4 shows the results of tests on the effect of fund flows on performance persistence based on four-factor abnormal returns that allows for time-varying factor loadings, which is very similar to the results shown in table 7.3. When funds are classified into quintiles in terms of four-factor abnormal returns that allows factor loadings to vary over time, the spread-position portfolio that goes long bottom quintile high-inflow subgroup funds and shorts bottom quintile low-inflow subgroup funds shows evidence of underperformance for UK domestic funds when relative fund flows are utilized though no significant abnormal performance is observed for portfolios 1 high and 1 low in the evaluation period. It is consistent with Berk and Green (2004)'s prediction. The best performing international funds with lower inflows generate higher alpha, which is statistically significant than those winner international funds with larger net inflows though there is no evidence of significant underperformance of spread-position portfolio 5 high – 5 low. The results shown in Table 7.4 give identical inferences as our previous findings in Table 7.3.

As discussed in Chapter 6, the flow-performance relationship for the best performing domestic funds is more convex than that for the top quintile international and developed market funds. Although both domestic fund investors and international fund investors are found to be reluctant to punish the worst performing funds, domestic fund investors appear to be more sensitive to poor performance and less reluctant to direct money out of past losers than international and developed market fund investors. Therefore, we expect to observe more performance persistence in the best performing international funds and more performance persistence in the worst performing international funds compared to their domestic counterparts according to Berk and Green (2004), which suggest that the lack of performance persistence in mutual funds can be attributed to large money injections into the best performing funds and money outflows from the worst performing funds. As shown in Table 7.3 and 7.4, Compared to domestic funds, international funds show more performance persistence in funds that have delivered superior performance and experienced smaller money inflows at horizon of 12 months. However, we fail to find evidence of more performance persistence in the worst performing international funds in comparison to UK domestic funds. There might be two possible explanations. Firstly, the fund inflows to either past winner or loser international funds are not large enough to introduce decreasing returns to scale. Hence the outperformance might persist into the future while the underperformance might reverse for international funds. In this sense, it is not really against Berk and Green (2004)'s

arguments. Secondly, the superior performance achieved by international funds in the evaluation period probably comes from the abnormal returns generated by emerging market funds as there is little evidence of outperformance for top develop market funds in the evaluation period. UK domestic unit trusts/OEICs, on the other hand, appear to be more difficult to achieve persistent superior performance and more likely to consistently underperform the market. It might be due to the relatively less investment opportunities in domestic market than global markets. Compared to international fund managers who are able to diversify their investment portfolios and explore profitable projects globally, domestic fund managers who compete with each other for good investments are more likely to exert greater price impact on the underlying asset market. The results reported in Table 7.3 and 7.4 also indicate that the equilibrating mechanism of fund flows are likely to have impact on performance persistence at term horizon of 12 months for UK domestic unit trusts. At the horizon of 12 months, larger fund inflows can result in inferior performance especially for the worst performing domestic funds.

Table 7. 4: The Effect of Fund Flows on Performance Persistence Based on Four-Factor Abnormal Returns Allowing for Time-Varying Factor Loadings

Fund Flow Measurement	Ranking	UK Domestic	UK-based International	Developed Countries
Absolute Flow	5 high	-0.0002	0.0023	0.0013
	5 low	-0.0008	0.0033*	0.0018
	1 high	-0.0010	0.0006	-0.0010
	1 low	-0.0008	0.0013	0.0002
	5 high-5 low	0.0005	-0.0008	-0.0005
	1 high-1 low	-0.0004	0.0005	-0.0002
Relative Flow	5 high	-0.0003	0.0025	0.0016
	5 low	-0.0004	0.0033*	0.0015
	1 high	-0.0013	0.0003	-0.0010
	1 low	-0.0007	0.0011	-0.0001
	5 high-5 low	-0.0000	-0.0006	0.0001
	1 high-1 low	-0.0009*	0.0005	0.0002

Funds are ranked into quintiles based on their abnormal returns from Carhart four-factor model with allowance of time-varying factor loadings estimated over previous 24 months, and then sorted based on whether they receive higher or lower inflows than the median fund inflows of all other funds classified in the quintile at the end of each formation period. The monthly equally weighted average returns are computed for four portfolios resulted from the double sorting procedure in the formation period, which are top quintile performers with higher than median flows (5 high), top quintile performers with lower than median flows (5 low), bottom quintile performers with higher than median flows (1 high) and bottom quintile performers with lower than median flows (1 low) as well as two spread-position portfolios: 5 high – 5 low and 1 high – 1 low in the subsequent evaluation period. The performance is measured using Carhart four-factor model and then reported. We use both absolute fund flows and relative fund flows in our analysis for robustness. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

7.4 Conclusion

In this chapter, we have tested performance persistence in UK domestic and international equity mutual funds using the recursive portfolio approach proposed by Carhart (1997) over alternative ranking and evaluation periods. For UK domestic funds, there is little evidence of persistent patterns in performance over intermediate term horizons. However, we find greater persistence in domestic fund performance at very short and long term horizons. Over one month ranking and evaluation period, we have found persistence in both best performing and worst performing domestic funds while at 36-month term horizon, we have observed that the persistence in performance is mainly caused by the persistent underperformance of the bottom quintile domestic funds. It is worth noting that when we further analyze the performance persistence of domestic funds in each IMA sector, we have discovered that the performance persistence in UK All Company funds at the shortest and the longest term horizons results from the persistent underperformance in the worst performing funds while the persistent pattern in UK Smaller Companies fund performance over one-month and three-month holding periods is primarily due to the persistent outperformance in the best performing funds.

For the entire sample of UK-based international funds, we find some evidence of performance persistence at short and intermediate term horizons. The significant persistence documented for international fund performance mainly results from the persistent outperformance of the best performing funds. UK international fund investors are less sensitive to past superior performance compared to UK domestic fund investors but slightly more reluctant to realize loss from the worst performing funds. Therefore, fund managers of the top performing international funds can operate their funds more efficiently, look for new profit opportunities worldwide and manage to consistently generate superior performance compared to domestic fund managers. We have classified UK-based international equity mutual funds into three categories in terms of their regional focus. It is not surprising that we find little evidence of performance persistence for international funds mainly investing in developed countries. Funds in this category exhibit a more convex flow-performance relationship, which is very similar to UK domestic unit trusts. For globally diversified international funds, we find evidence of performance persistence at almost all term horizons. Investors who are interested in this type of funds attempt to benefit from global diversification. They are believed to be less sensitive to past performance, and thus lead to persistence in the performance of globally

diversified funds. Regionally focused international funds that include all emerging market funds in our sample are found to cause the persistent outperformance of the best performing international funds. International funds that primarily invest in certain regions of great profit opportunities might benefit from the consistent economic boom in the local market, and therefore resulting in persistent performance of the top performing regionally focused funds.

To empirically test the equilibrating mechanism of fund flows in Berk and Green (2004), we employ the double sorting approach utilized by Bessler et al. (2010), which incorporates underlying performance ranked portfolios and associated fund flows to examine the impact of fund flows on performance persistence. The results for UK domestic funds based on past 12-month abnormal returns and associated net fund inflows support Berk and Green (2004)'s prediction of fund flows. We find that the portfolio of the past loser UK domestic funds that suffer from larger fund flows underperform the portfolio of the worst-performing domestic funds that attract lower net inflows. For UK-based international funds, although the best performing international funds with lower-than-median fund inflows show weak evidence of performance persistence, there is little evidence that supports Berk and Green (2004)'s prediction of fund flows.

Due to the limited access to information on fund size and fund flows, we are not able to extend the empirical test of Berk and Green (2004) at longer-term horizons, say 36 months. It might be interesting as we find significant performance persistence for the worst performing UK domestic unit trusts over a 36 month formation and evaluating period. Besides, it is worth studying the emerging market funds in depth, as it seems that emerging market funds contribute the most to the outperformance and performance persistence of the best-performing international funds.

Our results suggest that UK retail investors that mainly invest in domestic unit trusts should be cautious when they chase past performance, as fund flows will deteriorate superior performance beyond 12 months. It is pointless of holding past loser funds over long term as the poorly performance persist into the future. From the perspective of UK retail investors that mainly invest in UK-based international equity mutual funds, our findings suggest that it is profitable to make investments to the best performing regionally focused international funds as the outperformance persist. However, one might not expect to obtain consistent

abnormal returns from investing in developed market funds, as their performance is not persistent as those UK unit trusts that focus on the domestic market.

Table 7. 5: Summary of Hypotheses Tested and Main Results

Hypotheses Tested	**Results**
H14: There is less performance persistence in international than domestic funds.	Domestic funds: short-term (one month) persistence of top and bottom funds has been observed. Only bottom funds persistently underperform over thirty-six months. International funds: short-term (six month) persistence in performance disappears after twelve months. Developed market funds: there is little evidence of performance persistence longer than one month. Globally diversified funds: performance persistent has been observed over both short and longer periods, which is mainly due to persistent underperformers. Regionally diversified funds: there is strong performance persistence of best performing funds, which could be explained by the use of risk factors developed for developed markets.
H15: Best (worst) performing mutual funds that experience large (small) net inflows will have worse (better) subsequent performance than the best (worst) performing mutual funds that experience small (large) net inflows.	The results for UK domestic funds based on past 12-month abnormal returns and associated net fund inflows support Berk and Green (2004)'s prediction of fund flows. We find that the portfolio of the past loser UK domestic funds that suffer from larger fund flows do underperform the portfolio of the worst-performing domestic funds that attract lower net inflows. For UK-based international funds, there is little evidence that decreasing returns to scale from fund flows are the equilibrating mechanism that lead to no persistence in fund performance.

Chapter 8 Conclusion and Future Research

8.1 Conclusion

This thesis studies the performance, performance persistence and fund flows for UK domestic and international equity mutual funds. We utilize a new dataset consisting of 650 UK domestic equity mutual funds and 627 UK-based international equity mutual funds over the sample period from January 1998 to March 2015. The comparative analysis provides new evidence on mutual fund market in the UK allowing for the effects of the financial crisis post-2008 and contribute to existing literature with the main motivation for this thesis is to empirically test the two-step flow-performance relationship in particular the Berk and Green (2004) model of fund flows.

We find little evidence that UK domestic and international equity mutual funds earn positive abnormal returns on a risk-adjusted basis across all investment objectives and all benchmarks. Neither UK domestic unit trusts nor international mutual funds have the ability to time the market as well as generate positive alphas in recessions and post the 2008 financial crisis. The finding that fund size is inversely correlated to subsequent performance for UK domestic unit trusts also applies to international unit trusts while controlling for other fund characteristics including fund family size, total expenses and fund ages, which has great implications for the empirical test of Berk and Green (2004) model, which assumes diseconomies of scale at fund level. We find evidence that for both UK domestic and international mutual funds, there exist a small number of fund managers who possess superior skill to outperform the benchmark.

The flow-performance relationship is more convex for the best performing UK domestic funds in comparison to the best performing international mutual funds while the sensitivity of fund flows to past performance is unstable for UK domestic funds over time as domestic fund investors show more aggressive return chasing behavior after 2008. Compared to domestic investor flows, international fund flows are more sensitive to risk-adjusted returns than raw returns especially the most recent risk-adjusted performance. However, we find that domestic fund investors become more sensitive to Jensen's alphas than raw returns post the 2008 financial crisis. Our findings suggest that the discrete event of beating a market benchmark is important in determining future fund flows to domestic and international fund investors. In

addition, search costs can affect the flow-performance sensitivity for UK domestic and international mutual funds when we use fund total fees and fund family size as material measures for search costs.

There is little evidence of performance persistence for UK domestic equity funds at the intermediate term though some evidence of persistence in UK domestic fund performance at the short and the long term has been found while the long-term persistence in domestic fund performance is mainly caused by the persistent underperformance of the bottom quintile funds. For UK-based international funds, there is some evidence of performance persistence at short and intermediate term horizons. Regionally focused international funds that include all emerging market funds in our dataset have been found to cause the persistent outperformance of the best performing international funds. The results of the empirical test of the equilibrating mechanism of fund flow in Berk and Green (2004) suggest that domestic funds that attract large net fund inflows do not outperform domestic funds that have smaller fund inflows over 12-month holding period. It supports the prediction of Berk and Green (2004). However, the findings for international equity mutual funds do not support Berk and Green (2004)'s prediction on fund flows.

8.2 Implications and Suggestions

Our findings contribute to existing literature on mutual fund performance, flow-performance relationship, and performance persistence. The implications can be looked at from three different perspectives. From a retail investor's perspective, since both actively managed UK domestic and international funds show no evidence of superior performance and active funds in general charge higher fees than passive funds, retail investors might be worse off investing in actively managed mutual funds especially in recessions. The poor market timing skills of UK domestic and international unit trusts/OEICs would make it difficult for mutual funds that adopt market timing strategies to attract new investments. Although there exist skilled fund managers who have sufficient ability to generate abnormal returns, the number of such fund managers can be too small for investors to identify. For the average individual investors, picking skilled managers can be very difficult and requires sophisticated filtering procedures (Cuthbertson, Nitzsche and O'Sullivan, 2010b). Our results for performance persistence suggest that UK retail investors that mainly invest in domestic unit trusts should be cautious when they chase past performance, as fund flows will deteriorate subsequent abnormal

returns. In particular, it is pointless of holding past loser funds over long term as the poorly performance persists into the future. From the perspective of UK retail investors that mainly invest in UK-based international equity mutual funds, our findings suggest that it is profitable to make investments to the best performing regionally focused international funds as their outperformance persists. However, one might not expect to obtain consistent abnormal returns from investing in developed market funds, as their performance is not persistent as UK domestic unit trusts.

Fund managers, on the other hand, should focus on stock picking rather than market timing as no evidence of market timing ability exits. Although the findings suggest that skilled UK domestic funds tend to be in income and small cap styles rather than growth style while skilled international funds are mostly found to be emerging market funds, the lack of managerial skill among active domestic and international equity mutual funds would cast doubt on whether active fund managers should charge higher management fees than passive fund managers. Our empirical findings on flow-performance relationship add to our understanding of investor behaviour. The evidence shows that the sensitivity of investor fund flows to past performance, fund fees, overall fund risk changes over time. If fund managers learn about the changing needs of investors and the state dependent investor behaviour, they might be able to improve their service and attract more investments. Besides, domestic fund managers who can only achieve moderate performance can boost fund flows by exerting more effort on marketing. However, the convexity of the flow-performance relationship can create incentive for fund managers to adopt risk-taking behaviour, given their compensation structure (Keith C Brown, Harlow and Starks, 1996; Chevalier and Ellison, 1997). A more convex flow-performance relationship might motivate fund managers to engage in risk-taking as they can be rewarded more if they outperform but lose less if they underperform, which can further affect market prices and market efficiency (Ferreira et al., 2012). Even the evidence has shown that fund investors prefer less risky funds, it may not mitigate fund managers' risk-taking behaviour.

From a regulator's perspective, the evidence on no abnormal returns generated by active management might suggest that the large fund flows into active equity funds can be a misallocation of resources. It is necessary to regulate the advertising and marketing of mutual fund performance by requiring fund managers to caution investors against relying heavily on performance without risk adjustment and short term superior performance as outperformance

will not persist. Regulators may also require better fund disclosure that enables investors to access to most recent and detailed fund information.

8.3 Future Research

Our analysis of fund performance can be further improved by employing conditional factor models to measure fund performance and construct regional risk factors for international equity mutual funds especially the emerging market funds. With respect to the test of relationship between lagged fund size and fund performance, Pástor, Stambaugh and Taylor (2015) point out that neglect of endogeneity of fund size might lead to wrong statistical inference when estimating the effect of fund size on performance. To address omitted variable bias and finite-sample bias in traditional regression-based methodology, we can further improve our research by employing the recursive demeaning approach advocated by Pástor, Stambaugh and Taylor (2015) to analyze the relationship between fund size and expected returns. In this thesis, we base our analysis of manager skill on the results generated by the bootstrap method employed by Fama and French (2010), which is a modified version of the residual resampling procedure employed by Kosowski et al. (2006). Although their resampling method maintains the cross-correlation of fund returns, it still suffers from the same problem as Kosowski et al. (2006)'s approach: losing autocorrelations in returns as well as time variation in the regression slopes. This issue can be addressed by extend the exiting bootstrap simulation procedure to include blocks of consecutive data[45]. In future research, it is worth examining manager skill using a modified block bootstrap method and make comparisons with the results we have obtained in this thesis.

The dataset we employ in this thesis suffers from survivorship bias problem, which is also a major issue for most of the studies on UK mutual fund industry. Although we expect that the survivor bias will not significantly distort our results, the reliability of the findings will substantially improve if we can have access to a survivor-bias-free database that is comparative to the survivor-bias-free CRSP Database in the US. Due to the limited length of sample period, we test fund flows at quarterly frequency. Although it has been widely applied in fund research, our research can be further improved to allow comparison with existing evidence and acquire more robust results if we could extend our dataset and use annual fund

[45] We thank Professor David Blake for his suggestions about modified block bootstrap method.

flows as the dependent variable in the tests. Besides, since we do not have complete information on fund size, fund flows, fund family size and expenses information, the results about the impact of fund characteristics variables on flow-performance relationship are less robust even though we have done a lot of robustness checks. This research can be further extended to compare the impact of fund inflows and fund outflows to fund performance for UK domestic and international equity mutual funds as some literature argue that there is significant difference between mutual fund investor's buying and selling behaviour (e.g. Keswani and Stolin, 2012).

Regime-switching model can be applied to study the changes in the sensitivity of fund flows to past performance in mutual funds over time. Instead of splitting the sample under our own definition of breakpoints, we are interested in identifying the structural breaks and investigate the cause of investor behaviour changes.

A potential direction for future research is to study individual investor sophistication, risk aversion and loss aversion through well designed lab experiment and survey, which can help us gain a better understanding of investor behaviour.

Appendix

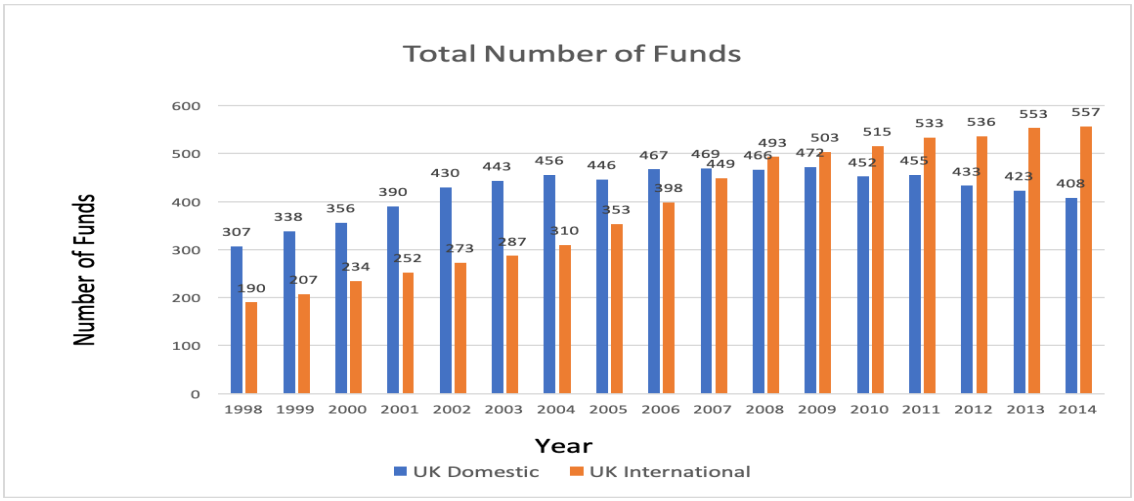
Table 4. 12: Comparison of OEIC and SICAV

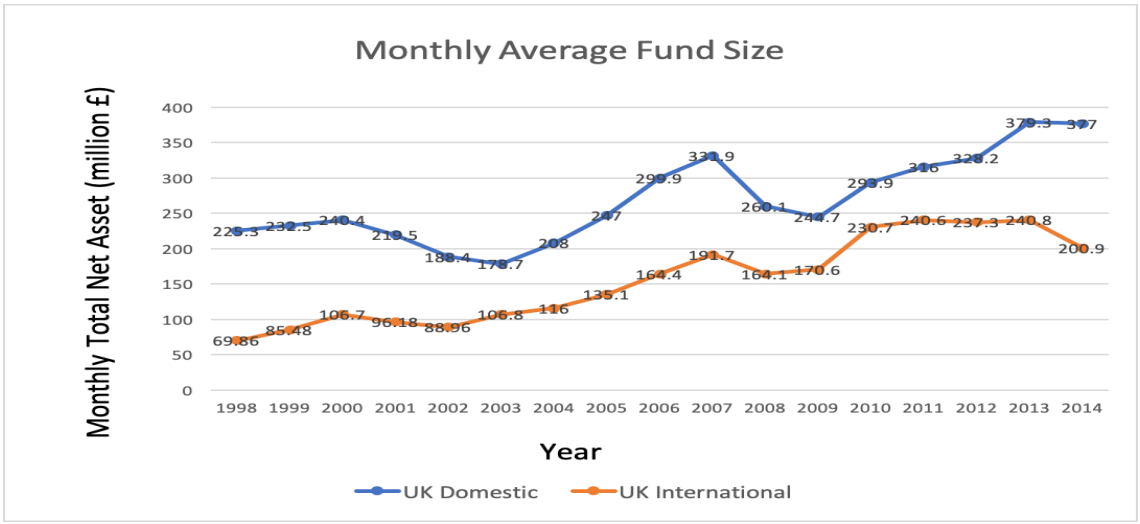
		OEIC	SICAV
Legal Structure and Regulation	Definition	Open-ended investment company (UK-domiciled)	Société d'investissement à capital variable (investment company with variable capital) (Luxembourg domiciled)
	Background	Commonly used in the UK; similar structures also used in other regions	Commonly used in Western Europe, also in other regions
		Introduced in the UK in 1997 as a flexible alternative to unit trusts	Legal company structure introduced early in the last century
	Legal Structure/UCITS	An OEIC can be established as an umbrella company with a number of sub-funds, or as a stand-alone fund	A SICAV can be established as an umbrella company with a number of sub-funds, or as a stand-alone fund
		Can issue a range of share class types which may be differentiated by fee structure, distributions and currency; including currency hedged or unhedged shares	Can issue a range of share class types which may be differentiated by fee structure, distributions and currency; including currency hedged or unhedged shares
		Can be established as a UCITS (Undertakings for Collective Investment in Transferable Securities) or retail non-UCITS	Can be established as a UCITS (Undertakings for Collective Investment in Transferable Securities) or retail non-UCITS
	Regulatory authority	Financial Conduct Authority (FCA), in the UK	Commission de Surveillance du Secteur Financier (CSSF), in Luxembourg
	Corporate governance	The Authorised Corporate Director (ACD) is responsible for the day-to-day operation of the OEIC	A SICAV has a Board of Directors, which can delegate management responsibility to a management company
	Role of Depository/Custodian	A Depositary is responsible for the custody of fund assets	A Custodian (Luxembourg-based) is responsible for the custody of fund assets and ensuring the interests of investors are maintained
		The Depositary is also responsible for oversight of the ACD to ensure the interests of investors are protected	Oversight is usually undertaken by the Board of Directors
		The Depositary and ACD must be completely independent	
	Segregation of liability between sub-funds	Legislation to allow the segregation of liability between sub-funds in an umbrella OEIC is provided for under UK law	Segregation of liability between sub-funds is provided for under Luxembourg law
		This means that assets in each sub-fund are ring-fenced from others in the range	
Fund Taxation	Fund income	The OEIC is in principle subject to UK corporation tax at 20%	No tax is levied on the fund – all tax arises in the hands of the investor
		Interest income and property income are taxable; however, expenses can be deducted	

		which often reduces the effective tax to nil	
		Dividends received by a fund are not taxable	
		Capital gains realised by the fund are exempt from tax	
	Withholding tax	OEIC funds pay withholding tax on foreign dividends, levied by the country in which the dividend is paid	SICAV funds pay withholding tax on foreign dividends, levied by the country in which the dividend is paid
		Due to the wide range of tax treaties in place with the UK, withholding tax on investment income is often reduced	SICAV funds benefit from certain tax treaties which can reduce the withholding tax to be applied
	Other fund tax	None	Taxe d'abonnement of 0.05% pa for retail investors and 0.01% for institutional investors, based on fund net asset value
Investor taxation	Income and capital gains	Most investors are taxed only on the actual distributions received, or on deemed investment returns from funds that are reported to them	Most investors are taxed only on the actual distributions received, or on deemed investment returns from funds that are reported to them
	Interest distributions	There is no withholding tax on distributions from OEIC funds.	There is no withholding tax on distributions from SICAV funds

The Above Table is an edited version taken from the document "M&G Retail funds OEIC & SICAV fund structures".

Figure 4. 1: Number of Funds, Monthly Average Fund Size and Relative Net Flows from 1998 to 2014





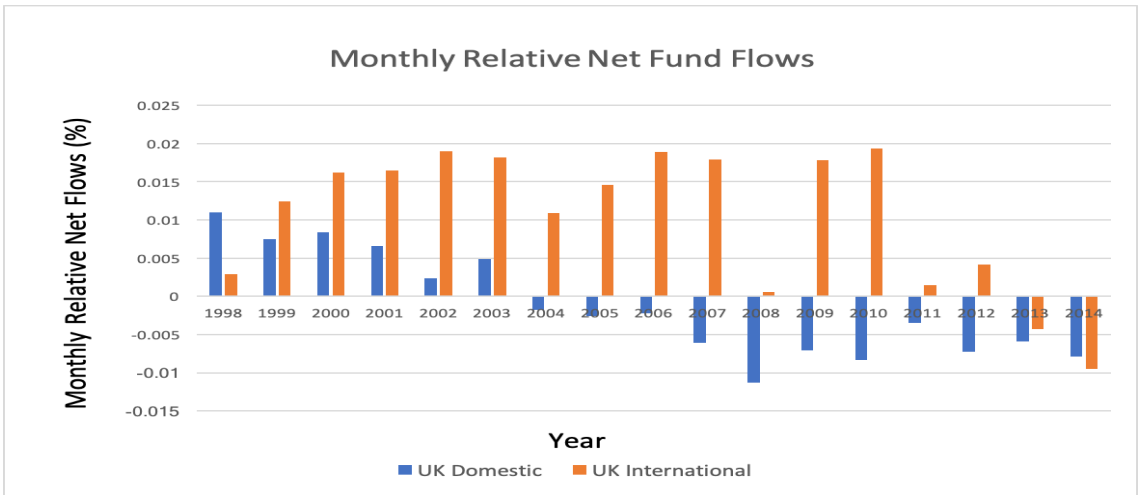


Table 4. 13: Descriptive Statistics for Emerging Market Funds 1998.1-2015.3

	Entire Sample Net Return	Entire Sample Gross Return	Entire Sample Gross Return+Initial Load	Obs.	No. of Funds
Emerging Market Global	0.57%	0.68%	0.76%	9,044	87
	(6.28%)	(6.28%)	(6.28%)		
Emerging Market India	1.21%	1.33%	1.41%	1,517	14
	(8.33%)	(8.33%)	(8.33%)		
Emerging Market Great China	0.88%	1.00%	1.08%	3,099	28
	(6.63%)	(6.63%)	(6.63%)		
Emerging Market Latin America	0.51%	0.62%	0.70%	2,538	19
	(7.86%)	(7.86%)	(7.86%)		
Emerging Market Europe	0.42%	0.55%	0.63%	1,308	11
	(8.10%)	(8.10%)	(8.10%)		
Onshore	0.65%	0.77%	0.85%	13,022	117
	(6.86%)	(6.86%)	(6.86%)		
Offshore (Luxembourg)	0.67%	0.80%	0.88%	6,137	60
	(7.49%)	(7.49%)	(7.49%)		

Table 5. 15: Whether UK Domestic and International Funds Perform in the Subperiods: Before (1998.1-2008.3), During (2008.4-2009.6) and After (2009.7-2015.3) the 2008 Crash, Defined by ONS

Factor Model	Sample	Sub periods	No. Obs	Alpha	Alpha SE	β_{mt}	β_{mt} SE	TM	R^2
One Factor Model	UK Domestic	Before	123	0.086%	0.0012				0.90
		During	15	0.070%	0.0047				0.95
		After	69	0.196%	0.0014				0.90
	International	Before	123	0.230%	0.0019				0.83
		During	15	0.090%	0.0066				0.90
		After	69	-0.289%	0.0022				0.83
Four Factor Model	UK Domestic	Before	123	-0.017%	0.0008				0.97
		During	15	0.362%	0.0052				0.98
		After	69	0.020%	0.0012				0.95
	International	Before	123	0.308%*	0.0018				0.85
		During	15	0.028%	0.0049				0.98
		After	69	-0.280%	0.0020				0.86
Four Factor Model with Market Timing	UK Domestic	Before	123	0.068%	0.0009	-0.52	0.40	-0.013%	0.97
		During	15	0.842%	0.0051	-1.23*	0.60	0.268%	0.98
		After	69	0.005%	0.0014	0.16	0.75	0.021%*	0.95
	International	Before	123	0.327%	0.0022	-0.09	0.49	0.309%*	0.85
		During	15	-0.107%	0.0075	0.38	1.22	0.102%	0.98
		After	69	-0.408%*	0.0024	1.10	1.25	-0.277%	0.86

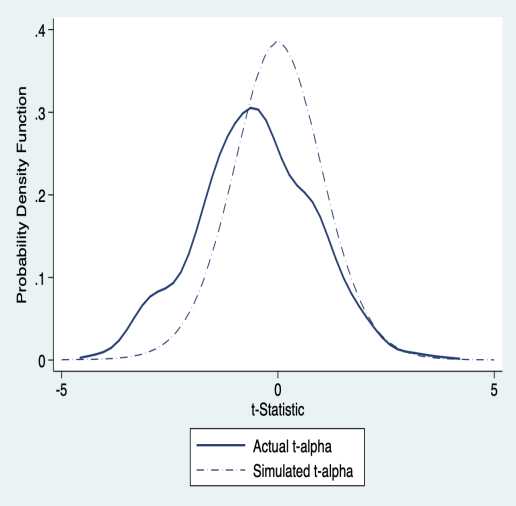
Table 5. 16: Whether Fund Size Erodes Fund Performance for Developed Market Funds

				Equally Weighted						Value Weighted					
Factor Model	Sample	AUM Quins	No. Obs	Alpha	Alpha SE	β_{mt}	β_m SE	TM	R^2	Alpha	Alpha SE	β_{mt}	β_m SE	TM	R^2
One Factor	Developed	Q1	206	-0.042%	0.0011				0.88	-0.048%	0.0012				0.87
Model	Countries	Q2	206	0.060%	0.0011				0.88	0.095%	0.0011				0.88
		Q3	206	-0.001%	0.0012				0.87	0.042%	0.0012				0.87
		Q4	206	0.053%	0.0012				0.88	0.109%	0.0012				0.88
		Q5	206	0.059%	0.0012				0.87	0.078%	0.0014				0.85
Three Factor	Developed	Q1	206	0.011%	0.0011				0.89	0.010%	0.0011				0.89
Model	Countries	Q2	206	0.106%	0.0011				0.89	0.139%	0.0011				0.89
		Q3	206	0.040%	0.0012				0.88	0.084%	0.0012				0.88
		Q4	206	0.107%	0.0012				0.89	0.163%	0.0011				0.89
		Q5	206	0.101%	0.0012				0.87	0.125%	0.0013				0.85
Four Factor	Developed	Q1	206	0.040%	0.0010				0.89	0.036%	0.0011				0.89
Model	Countries	Q2	206	0.128%	0.0011				0.89	0.165%	0.0011				0.89
		Q3	206	0.071%	0.0011				0.88	0.112%	0.0011				0.88
		Q4	206	0.131%	0.0011				0.89	0.183%	0.0011				0.89
		Q5	206	0.120%	0.0012				0.87	0.150%	0.0013				0.85
Four Factor	Developed	Q1	206	-0.017%	0.0012	0.28	0.41	0.0379%	0.89	-0.055%	0.0013	0.44	0.44	0.033%	0.89
Model with	Countries	Q2	206	0.114%	0.0012	0.07	0.38	0.127%	0.89	0.147%	0.0012	0.09	0.37	0.164%	0.89
Market		Q3	206	0.068%	0.0013	0.02	0.33	0.071%	0.88	0.097%	0.0013	0.07	0.33	0.112%	0.88
Timing		Q4	206	0.106%	0.0013	0.12	0.34	0.130%	0.89	0.148%	0.0013	0.17	0.34	0.182%	0.89
		Q5	206	-0.010%	0.0014	0.63	0.40	0.115%	0.875	0.000299	0.00148	0.582	0.414	0.145%	0.855

Table 5. 17: Summary of Skill from Bootstrap Simulations

		Parametric		Bootstrapped Alphas		Bootstrapped t-Statistics	
		5% sig. level	10% sig. level	5% sig. level	10% sig. level	5% sig. level	10% sig. level
UK	Positive Skill (%)	4.92	7.85	4.92	7.69	6.31	11.69
	Negative Skill (%)	11.85	15.54	7.69	11.85	14.77	22.31
	No Skill (%)	83.23	76.61	86.39	80.46	78.92	66
International	Positive Skill (%)	3.19	6.22	3.35	6.06	5.58	9.89
	Negative Skill (%)	10.05	14.35	7.97	12.92	12.60	20.89
	No Skill (%)	86.76	79.43	88.68	81.02	81.82	69.22
Developed Market	Positive Skill (%)	2.83	5.01	2.83	4.14	4.58	7.84
	Negative Skill (%)	13.29	18.52	10.24	16.34	16.56	25.93
	No Skill (%)	83.88	76.47	86.93	79.52	78.86	66.23

Figure 5. 3: PDF and CDF for Developed Market Funds



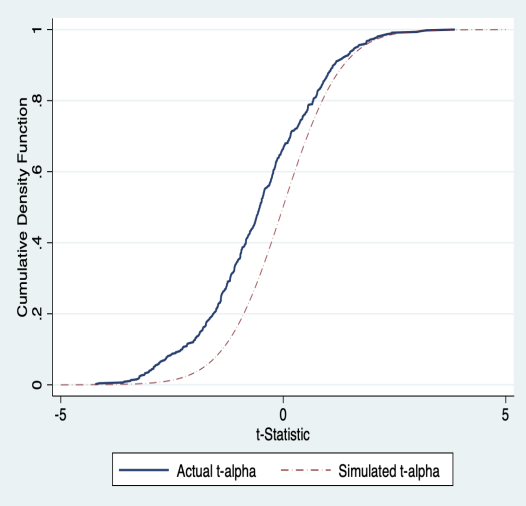


Table 6. 9: Panel Regressions of UK-Based International Fund Performance on Exchange Rate Fluctuations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Model1	Model2	Model3	Model4	Model5	Model6	Model7
$(Rm-Rf)_t$	0.924***	0.976***	0.972***	0.977***			
	(0.005)	(0.007)	(0.007)	(0.007)			
SMB_t	0.288***	0.069***	0.065***	0.051***			
	(0.012)	(0.008)	(0.009)	(0.010)			
HML_t	0.013*	-0.125***	-0.121***	-0.134***			
	(0.008)	(0.012)	(0.013)	(0.015)			
UMD_t	0.031***	-0.030***	-0.035***	-0.027***			
	(0.003)	(0.005)	(0.005)	(0.006)			
FX_t		-0.002***	-0.002***	-0.002***	-0.001***	-0.001***	-0.006***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
$lnAUM_{t-1}$				-0.001***	-0.001***	-0.001***	-0.001***
				(0.000)	(0.000)	(0.000)	(0.000)
$lnFAUM_{t-1}$				-0.000	0.000	-0.000	-0.000
				(0.000)	(0.000)	(0.000)	(0.000)
FMC_{t-1}				-103.439***	-148.228***	-99.369***	-815.903
				(11.606)	(12.352)	(10.948)	(502.588)
$1nAge_t$				-0.004***	-0.002***	-0.004***	-0.002**
				(0.001)	(0.000)	(0.001)	(0.001)
$Correlation_{t-1}$			-0.012***	-0.012***		-0.012***	-0.014***
			(0.001)	(0.001)		(0.001)	(0.002)
Constant	-0.000***	0.000***	0.010***	0.206***	0.279***	0.199***	1.539
	(0.000)	(0.000)	(0.001)	(0.022)	(0.023)	(0.020)	(0.948)
Time Effects	No	No	No	No	No	No	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	84006	77,963	70,808	54,096	57,918	54,096	54,096
R-squared	0.778	0.694	0.705	0.711	0.015	0.021	0.248

Table 6.9 displays the panel estimates of impact of change in exchange rate on fund performance based on net returns controlling for fund characteristics including fund family size, expense, age and correlation between international fund return and domestic market return. Model 1 is the standard Carhart four-factor model. Model 2 is extended factor model including monthly change in exchange rate but without any time effects. Model 3 extends factor model by including monthly change in exchange rate and correlation between international fund

return and domestic market return but without any time effects. Model 4 further extends standard factor model by including change in exchange rate and correlation between international fund return and domestic market return and other fund characteristics variables without time effects. Model 5 follows Joseph Chen et al. (2004) who estimated abnormal returns from Carhart four-factor model for each fund first, and then regress the abnormal returns on exchange rate fluctuations and other fund characteristics variables but except correlation between international fund return and domestic market return. Model 6 extend model 5 by including correlation between international fund return and domestic market return. Model 7 extends Model 6 by introducing time effects. The dependent variables in the panel regression are based on monthly net returns over 1998.1-2015.3. (Rm-Rf)t is excess returns on a market benchmark. SMBt, HMLt, UMDt represent size, value and one-year momentum effect respectively. A series of fund characteristics include fund size lnAUMt-1, which is measured by relative fund size defined as a fund's total asset under management relative to the average value of assets under management across all funds in a month t, fund family size lnFAUMt-1, which is measured by the ratio of a fund family's asset under management to the average value of the assets under management across all fund families in a month t, expenses FMCt-1 and Age 1nAget-1, which is measured by 1n (Aget-1 +1). FXt measures the monthly percentage change in the period average indirectly quoted exchange rates between the UK pounds and the local currency of each international fund currencies at time t while $Correlation_{t-1}$ measures the correlation of the net monthly return of each international fund with domestic market return over the previous 12 months. The constant represents α, the average skill across all fund managers. The time effects μ_t, which is measured by a monthly time dummy, is included in Model 7 but not reported. Standard errors are clustered by fund. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 6. 10: Fund Flows and Lag Structure for Past Performance over Two Subperiods: 1998.1-2007.12 and 2008.1-2015.3

	UK International		UK Domestic	
	1998.1 – 2007.12	2008.1 –2015.3	1998.1 – 2007.12	2008.1 – 2015.3
Constant	-0.082	0.673**	0.186	0.198
	(0.435)	(0.316)	(0.291)	(0.308)
$Return_{t-1}$	0.589***	0.402***	0.491***	0.782***
	(0.129)	(0.096)	(0.156)	(0.159)
$Return_{t-2}$	0.348**	0.308***	0.611***	0.718***
	(0.145)	(0.112)	(0.164)	(0.145)
$Return_{t-3}$	0.281**	0.399***	1.053***	0.587***
	(0.124)	(0.090)	(0.156)	(0.126)
$Return_{t-4}$	0.304**	0.389***	0.748***	0.506***
	(0.153)	(0.123)	(0.144)	(0.113)
$Return_{t-5}$	0.126	0.275***	0.378***	0.067
	(0.146)	(0.093)	(0.129)	(0.104)
$Return_{t-6}$	0.106	0.232**	0.138	0.062
	(0.133)	(0.097)	(0.109)	(0.117)
$Return_{t-7}$	-0.048	0.081	0.059	0.025
	(0.150)	(0.107)	(0.115)	(0.102)
$Return_{t-8}$	0.049	0.136	0.002	0.115
	(0.121)	(0.089)	(0.102)	(0.093)
$Return_{t-9}$	0.330***	0.048	0.051	0.114
	(0.120)	(0.068)	(0.116)	(0.081)
$Return_{t-10}$	0.227**	0.062	0.014	0.174**
	(0.095)	(0.064)	(0.118)	(0.081)
$Return_{t-11}$	0.094	0.049	0.067	0.191***
	(0.115)	(0.074)	(0.107)	(0.071)
$Return_{t-12}$	0.005	0.143*	0.105	0.119
	(0.098)	(0.081)	(0.091)	(0.073)
Observations	2,833	4,494	3,818	4,597
R-squared	0.188	0.078	0.110	0.104

Percentage flows are regressed on historical quarterly performance to examine the lag pattern for reaction of cash flow to past performance for two sub-periods: January 1998 – December 2007 and January 2008 – March 2015. Table 6.10 reports the results from estimating the fixed effect model given by equation (6.2). Robust standard errors are reported in parentheses. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

Table 6. 11: The Importance of Beating A Market Benchmark Over Time

	UK-based International				UK Domestic			
	FTSE ALL WORLD				FTSE ALL SHARES			
	1998.1-2007.12		2008.1-2015.3		1998.1-2007.12		2008.1-2015.3	
	RF	AF	RF	AF	RF	AF	RF	AF
Constant	0.137**	6.709	0.031	5.173	0.040*	-2.256	0.101***	8.002***
	(0.066)	(6.474)	(0.043)	(5.033)	(0.023)	(3.260)	(0.020)	(2.723)
OUTPERF Dummy	0.021**	1.509	0.019***	2.207***	0.029***	6.689***	0.005	1.791**
(outperf a benchmark)	(0.010)	(1.015)	(0.007)	(0.778)	(0.006)	(0.827)	(0.005)	(0.776)
Lagged	0.232***	-0.471	0.254***	6.941	0.202***	8.589	0.243***	18.267**
excess Return t-1								
(outperform)	(0.073)	(7.263)	(0.059)	(6.923)	(0.049)	(7.168)	(0.057)	(8.097)
Lagged	0.159	17.803	0.135**	3.792	0.218***	-12.409	0.195***	-1.660
excess Return t-1								
(underperform)	(0.110)	(11.031)	(0.058)	(6.840)	(0.067)	(9.706)	(0.060)	(8.536)
Jensen's Alpha t-1	0.347***	78.955***	0.464***	85.439***	0.226***	37.308***	0.466***	47.922***
(outperform)	(0.090)	(9.052)	(0.090)	(10.622)	(0.051)	(7.403)	(0.069)	(9.806)
Jensen's Alpha t-1	0.101	7.884	0.321***	37.743***	0.084	10.977	0.248***	20.626**
(underperform)	(0.112)	(11.169)	(0.074)	(8.620)	(0.059)	(8.631)	(0.070)	(9.857)
Control Variables include: Lagged flow, risk, total fees, fund size, fund age, fund family size and time and scheme interaction dummies for both types of funds, changes in the exchange rates and correlation of fund return with UK domestic equity market return for international funds only.								
Observations	4,773	4,784	8,560	8,575	8,696	8,694	8,999	8,992
R-squared	0.113	0.228	0.088	0.247	0.080	0.142	0.110	0.279

Table 6.11 reports results of the pooled time-series cross-sectional regression of percentage flows on net return in excess of market benchmark index for UK domestic and international equity mutual funds over two subperiods: January 1998 – December 2007 and January 2008 – March 2015. The definitions of all variables are identical to those in Table 6.4. White standard errors are reported in parentheses. Significance at the 1%, 5% and 10% are denoted by ***, **, * respectively.

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